NOAA Techniques Development Laboratory
Computer Program NWS TDL CP 93-2

AFOS SURFACE OBSERVATION DECODING

Silver Spring, Md.
September 1993

U.S. DEPARTMENT OF COMMERCE / National Oceanic and Atmospheric Administration / National Weather Service

PREFACE

The Techniques Development Laboratory's (TDL's) computer program (CP) series is a subset of TDL's technical memorandum series. The CP series documents computer programs written at TDL primarily for the Automation of Field Operations and Services (AFOS) computers.

The format for the series follows that given in the AFOS Handbook 5, Reference Handbook, Volume 6: Applications Programs, Part 1: Policy and Procedures, published by the Office of Technical Services/AFOS Operations Division.

NOAA Techniques Development Laboratory
Computer Program NWS TDL

CP 83-1 Gross Sectional Analysis of Wind Speed and Richardson Number. Gilhousen, Kemper, and Vercelli, May 1983. (PB83205062)
CP 83-2 Simulation of Spilled Oil Behavior in Bays and Coastal Waters. Hess, October 1983. (PB84122597)
CP 83-3 AFOS-Era Forecast Verification. Heffernan, Newton, and Miller, October 1983. (PB84129303)
CP 83-4 AFOS Monitoring of Terminal Forecasts. Vercelli, December 1983. (PB84145697LL)
CP 83-5 Generalized Exponential Markov (GEM) Updating Procedure for AFOS. Herrmann, December 1983. (PB84154822LL)
CP 84-1 AFOS Display of MDR Data on Local Map Background. Newton, July 1984. (PB84220797)
CP 84-2 AFOS Surface Observation Decoding. Perrotti, September 1984. (PB85137586)
CP 84-3 AFOS-Era Forecast Verification. Miller, Heffernan, and Ruth, September 1984. (PB86148319LL)
CP 85-1 AFOS Monitoring of Terminal Forecasts. Vercelli and Norman, May 1985. (PB85236388LL)
CP 85-2 AFOS Terminal Forecast Decoding. Vercelli, Norman, and Heffernan, October 1985. (PB86147360LL)
CP 85-3 AFOS-Era Forecast Verification. Ruth, Miller, and Heffernan, October 1985. (PB86148319LL)
CP 87-1 AFOS Terminal Aerodrome Forecast Formatting. Wantz and Eggers, July 1987. (PB8810449LL)
CP 87-2 AFOS-Era Forecast Verification. Ruth and Alex, July 1987. (PB88125570LL)
CP 87-3 Forecast Review. Wolf, July 1987. (PB88125588LL)
CP 87-4 AFOS Monitoring of MDR Data Using Flash Flood Guidance. Norman and Newton, October 1987. (PB88137450LL)
CP 87-5 AFOS Terminal Forecast Quality Control. Vercelli and Leaphart, December 1987. (PB88169925LL)
CP 88-1 AFOS Terminal Forecast Decoding. Vercelli and Leaphart, August 1988. (PB89101240LL)
CP 89-1 Structure Flow Diagram Generator. Adams, March 1989. (PB89195978AS)
CP 89-2 String Search. Adams, March 1989. (PB89195986AS)
CP 89-3 Extended Memory Library for AFOS Applications. Leaphart, June 1989. (PB92216290)

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Robert A. Beasley

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Robert A. Beasley

1. INTRODUCTION

The primary purpose of the program SAODECII is to decode surface aviation observations (SAO's) and similar marine observations available on the National Weather Service (NWS) Automation of Field and Operational Services (AFOS) computer system (NWS 1989a and NWS 1992a). SAODECII can decode SAO's observed and recorded in the United States and Carribean area [Federal Aviation Administration (FAA) 1991, NWS 1979, NWS 1981, NWS 1992b, NWS 1992c, NWS 1992d, Office of the Federal Coordinator for Meteorology (OFCM) 1984, OFCM 1988a, and World Meteorological Organization (WMO) 1988], Canada (Atmospheric Environmental Service 1977), and Mexico (Federal Aviation Administration 1984). These SAO's may be transmitted individually or collectively. Marine observations can also be decoded by SAODECII. Observations from buoys and ships taken worldwide can be decoded since they conform to World Meteorological Organization Code (OFCM 1988b, WMO 1989, and National Data Buoy Center 1990), as well as Coast Guard observations taken within the United States. Observations in METAR format cannot be decoded by SAODECII. All successfully decoded data are written to one or two Real Time Disk Operating System (RDOS) files (Data General Corporation 1974 and 1978), named SAODATA and/or SAODATASUP, for manual examination or subsequent use by other applications programs.

Command line switches offer the user a wide variety of options including: control of the decoding time interval and anchor time; control of output parameters and map backgrounds for subsequent plotting programs; and optional diagnostic print to the Dasher, line printer, or Printer Plotter Module (PPM). Furthermore, the user can specify the type and location of each station to be decoded through the RDOS file CCCLIST.nn.

A secondary plot file generator program PLTGEN, allows one to take the SAODECII output file SAODATA and create a Universal Graphics Generation (UGG) plot file (Davis 1983) as described in Appendix V. The output UGG file from PLTGEN may be stored as an RDOS file named GP or as an AFOS product NMCPLTSAO. In either case, the data output from PLTGEN can be used as input to a graphics generation program (e.g., PMOD or REGPLOT) to produce a graphic display of the data on an AFOS Graphics Display Module (GDM).

This publication, TDL CP 93-2, supersedes both TDL CP 84-2 (Perotti 1984) and the draft versions of this CP which are now operationally obsolete.

2. METHODOLOGY AND SOFTWARE STRUCTURE

Data flow and program relationships from program initiation to optional graphics plot file output are illustrated in Fig. 1. Software structures and load lines for SAODECII and PLTGEN are shown in Fig. 2. SAODECII is the only program required to decode observations and activate PLTGEN. SAODECII executes in the following manner: (1) reads optional switches from the command line, (2) sets certain logical variables and writes other switch

information required by PLTGEN to the RDOS file SAOXXX file (see Table 1 and Fig. 3), (3) reads the user specified station decoding list (CCCLIST.nn) and alphabetizes it if necessary, (4) reads the AFOS SKEL and DATAKEY0 files (NWS 1989b) to obtain half block numbers (RDOS locations) of desired observations (note this program uses direct database access for the greatest efficiency), (5) reads the specified observations from the local AFOS database files LOCAL1DATA, LOCAL2DATA, LOCALDATA, and REMOTEDATA as necessary, (6) decodes these observations and writes them in mixed integer/ASCII format to the RDOS file(s) SAODATA (old standard 48-word data file) and/or SAODATASUP (extended 96-word SAODATA file) (see Tables 2 through 7, and Figs. 4 and 5), and (7) optionally chains to PLTGEN to produce a UGG plot file for subsequent plotting by using the programs PMOD (Davis 1983) or REGPLOT (Chia 1984) in conjunction with GENUTF (Davis 1983).

A. PROGRAM SAODECII

The main program for decoding SAO's and marine observations (BOY's, SHP's, and CGR's) is SAODECII. The first task of this program is to read the command line arguments. Options not specified on the command line are assigned default values (see Table 1). After the command line is read, the user supplied and/or default values for the options are written to the RDOS file SAOXXX. The switch information stored in SAOXXX is used by PLTGEN. **Note that specials will only be decoded if the global "S" switch is included on the command line.**

After the command line is read, SAODECII reads the user specified and/or default station decoding list (CCCLIST.nn - see Fig. 6A). Each site will have, as before, the option of selecting the AFOS nodes (Weather Service Forecast Offices - WSFO's), and/or collectives for which it wishes to have observations decoded. In addition, each site will have the ability to decode individual observations within a node. The station lists may be styled according to one of three different methods, or styled as a combination of two or all three methods. These methods are discussed in detail in Appendix I.

In addition to United States surface observations, the decoder can also decode surface observations for Canada, Mexico, and some Caribbean stations (those which send observations in accordance with FMH No. 1 and not METAR). All of these observations are identified by the letters SAO in the CCCLIST.nn. Non-Mexican SAO's which are transmitted in collectives can be decoded as well, if they are properly specified in the RDOS data file SAOCLTVID.DT described later in this document (See Fig. 6B).

Marine observations can also be decoded by SAODECII. Ship observations will be decoded if the identifiers SHP, SHI, or SHN are included in the CCCLIST.nn. Buoy observations, including costal marine, drifting, and moored, will be decoded if the identifier BOY is included in the CCCLIST.nn. Coast Guard observations are decoded when the character string CGR is included in the CCCLIST.nn, and Great Lakes ship reports are decoded when LAW is included in the station decoding list.

A master CCCLIST.nn (denoted as CCCLIST.00), containing all of the decodable product categories (SAO, BOY, CGR, LAW, SHI, SHN, and SHP), is included with the SAODECII software package. Pneumonic formats and an extensive explanation of the elements included therein for all observation types which can be decoded by SAODECII are given in Appendix IV.

United States and Carribean SAO, LAW, and CGR observations are listed in the master CCCLIST.00 by their corresponding AFOS node (i.e., WSFO), while all BOY's, SHP's, SHN's, and SHI's are listed without reference to the local AFOS node, as these are stored as national products. Mexican SAO's are denoted by the international node IMX. The master CCCLIST.00 is shown in Fig. 6A. It should be noted that using the master CCCLIST.00 results in the decoding of all observations for all product categories listed above that are available in the local AFOS database.

SAODECII must also know if the SAO's to be decoded are within collectives or are transmitted on AFOS as one observation per AFOS key. This information is provided to SAODECII through the RDOS file SAOCLTVID.DT. A master SAOCLTVID.DT file is provided with the SAODECII software package and is also illustrated in Fig. 6B. All non-SAO observations are assumed to be transmitted in collectives, but will be decoded regardless of whether they are or not without further action on the part of the user.

After SAODECII has read the user specified decoding list CCCLIST.nn and the collective identification file SAOCLTVID.DT, it then reads in turn the SKEL and DATAKEY0 files to determine the RDOS locations of the desired observations. Since this decoder uses the direct database access method, data are then extracted directly from the four AFOS database files without going through the foreground for database access. This eliminates a time consuming step encountered in conventional AFOS programs which access the database.

Observations decoded are those which are found in the database that match those listed in the desired CCCLIST.nn and that are within the default or user specified closed decoding time interval of hhmm - bbbb and hhmm + eeee. Hhmm denotes the decoding interval anchor time (integer truncated), bbbb denotes the number of minutes to subtract from the anchor time to obtain the lower decoding boundary, and eeee denotes the number of minutes to add to the anchor time to get the upper decoding boundary (See Section 6 Part B). "Truncated time" refers to the truncation of time to the previous whole hour as the times are handled internally as integers and are thus truncated as integers (e.g., an "hhmm" of 1759Z will be truncated to 1700Z, and the decoding anchor time will thus be 1700Z).

B. PROGRAM PLTGEN

The purpose of the program PLTGTEN, to which SAODECII will chain if desired, is to create and store a UGG plot file. PLTGEN first reads the values stored in the SAOXXX file created by SAODECII. This file includes command line switch information which, among other things, defines how certain elements of the station plot model are to be plotted (e.g., whether to plot station ID's, what map background to use, etc.). See Table 1 for a complete listing of the information in the SAOXXX file.

PLTGEN then reads the SAODATA file and creates either the RDOS file GP or the AFOS product NMCPLTSAO (again depending on information in SAOXXX set by specific global switches in SAODECII). In either case, the file is output in UGG format. Appendix V includes a sample UGG plot file and defines the fields which can be output to this file. One should refer to the "PMOD Plotting Program for AFOS" (Davis 1983) for a complete explanation of the UGG plot file and how to use it.

PLTGEN must also read the RDOS file STDIR.MS to obtain latitude and longitude in GDM pixels, and zoom plot settings for most stations which are to be decoded. The zoom settings determine graphic zoom thresholds at which stations are first plotted. The user can regulate the plot density by assigning a zoom level setting for each station. Each AFOS site has the ability to change the zoom threshold values by editing the STDIR.MS file. Program ZOOMEDIT has been designed to do this and is discussed in Appendix II.

The STDIR.MS file is not required to determine the latitude and longitude for drifting and moored buoy reports, as such information is a part of the observation's code. However, for all other types of stations which are to be decoded, the STDIR.MS file is required. It is very important to note that stations not sending their latitude/longitude and not listed in the STDIR.MS file, **will be decoded by SAODECII, but will not be accepted by PLTGEN.** A master STDIR.MS file is maintained by NWS Central Region Headquarters (CRH). However, the user may edit the file locally using the SDEDIT program which is described in Appendix II.

C. PROGRAM SAODUMP

A third program, SAODUMP, exists for the purpose of printing out the decoded data in the standard SAODATA file. SAODUMP may be used as a diagnostic utility to obtain an unformatted printout of the SAODATA file in mixed ASCII/integer format (See Table 2) on the line printer or PPM. It should be noted that other and perhaps better means of printing diagnostics exist within SAODECII itself through use of the global "G" and "X" switches and the local "L" switch. SAODUMP can only print out the standard 48 word SAODATA file. The global "G" switch results in a printout of the extended SAODATASUP file, of which SAODATA is a subset.

3. PROCEDURES

The decoder is initiated from the DASHER by entering:

SAODECII/A/F/G/H/I/J/M/N/O/S/U/W/X/Y/Z
bb/B nn/C mmddyy/D e/E l/L p/P bbbbeeee/R hhmm/T

This entry will execute all programs from setting the optional switches through creating the plot file. The optional global and local switches and their default settings are given in Section 6 Part B.

The complete set of programs runs in 32K words of memory. The execution time varies with the complexity of the observations being decoded, the number of observations to be decoded, and the AFOS system workload. On the average, it takes approximately 0.7 seconds per observation to decode a set of 250 to 1000 observations on a Data General Eclipse S230 computer.

If SAODECII is run from an Alphanumeric Display Module (ADM), an alarm light will be activated upon completion of the program. If it is also run without use of the global "F" or "N" switches, a second alarm message will indicate that the plot file NMCPLTSAO has been stored in the database by PLTGEN. The user may then run one of the graphics generation programs to create a product displayable on the GDM. Normally, SAODECII, PLTGEN, and the graphics generation programs will be run from a macro as described in Appendix III.

The generation of graphic synoptic displays from plot files can be done by either program PMOD or REGPLOT. If the SAO Decoder is run with the global "W" switch, weather depiction displays (especially useful for aviation analyses) can also be generated using the program WXPLOT (Sunkel 1982). Appendix III briefly describes how to use these programs to plot data decoded by SAODECII. Approprite documentation should be consulted for more information on how to use PMOD, REGPLOT, WXPLOT, and GENUTF.

4. CAUTIONS

a. The maximum number of entries allowed in a CCCLIST.nn is 200. However, in most cases the total number of observations one can actually decode greatly exceeds 200 by use of the generic category specification in the CCCLIST.nn. Appendix I provides information on how to develop CCCLIST's.

b. A minimum of 509 RDOS blocks should be available for installation of SAODECII, PLTGEN, SAODUMP. In addition, if 250 observations are to be decoded, another 190 blocks will be required by SAODECII (files SAOXXX, SAODATA, and SAODATASUP), and PLTGEN (files GP and WXDATA.bb). These files do not all have to be stored in the same directory, as they can be moved to other directories and linked to SYSZ. See Section 6, Part A below for a complete breakdown of the RDOS block size required for SAODECII, PLTGEN, SAODUMP, and their related files.

c. The default map background is "B02". Any other valid AFOS map background extracted from "B01", "B02", or "B03" may also be used. PLTGEN may fail when certain map backgrounds not generated from these are used.

d. The default CCCLIST.nn extension is "00." If the file CCCLIST.00 is not present on your system (or not linked properly), and you fail to specify a specific CCCLIST extension through the local "C" switch, you will receive a "FATAL RUNTIME ERROR 14" - Input/Output Error. Likewise, if the CCCLIST.nn file does not terminate with a "999999999".

e. The SAO collective identification file, SAOCLTVID.DT, must exist regardless of whether or not you plan to decode such observations. If it does not exist and does not terminate with a "999", you will also receive a "FATAL RUNTIME ERROR 14" - Input/Output Error.

f. Six digits are required for specification of a specific date through the local "D" switch. The format is two digits for the month (mm), two digits for the day (dd), and the last two digits of the year (yy). Any number of digits other than six will result in a fatal error.

g. Eight digits are required for specification of the time range interval values. The first four digits (bbbb) denote the value to subtract from the anchor time to get the lower decoding time interval boundary, while the last four digits (eeee) denote the value to add to the anchor time to get the upper decoding time interval boundary. Any number of digits other than eight will result in a fatal error.

h. Four digits are required for specification of a specific time through the local "T" switch. The format is two digits for the hour (hh) and two digits for the minutes (mm). Any number of digits other than four will result in a fatal error.

i. **Make absolutely sure** that the AFOS database files REMOTEDATA, LOCALDATA, LOCAL1DATA, and LOCAL2DATA, as well as the SKEL and DATAKEY0 files, normally in the directory SYSA, are linked to the master directory. Otherwise, the Decoder will not run.

j. The Decoder is designed to recognize SAO's in the format prescribed in the appropriate Federal Meteorological Handbooks and Users Guides listed in the references. All other types of observations should be consistent with the format prescribed by the World Meteorological Organization (WMO). Observations deviating from these formats will likely cause misinterpretation of data, and in some instances cause the program to fail.

5. REFERENCES

Atmospheric Environmental Service, 1977: MANOBS: Manual of Surface Weather Observations, Environment Canada, 66 pp.

Chia, R. R., 1984: Displayable Graphics from Plot Files. NOAA Integrated Systems Laboratory Computer Program NWS ISL CP 84-1, National Weather Service, NOAA, U.S. Department of Commerce, 13 pp.

Data General Corporation, 1974: RDOS/DOS User's Handbook, Ordering No. 093-000053, Data General Corporation, Southboro, Massachusetts, 235 pp.

_____, 1978: RDOS/DOS User's Handbook, Ordering No. 093-000105, Data General Corporation, Southboro, Massachusetts, 216 pp.

Davis, R. A., 1983: PMOD plotting system for AFOS. NOAA AFOS Operations Division Computer Program NWS AOD CP 83-1, National Weather Service, NOAA, U.S. Department of Commerce, 50 pp.

Federal Aviation Administration, 1984: Mexico Flight Manual. Texas Aviation Commission, Austin, Texas, 133 pp.

_____, 1991: Observer Handbook (interim) Automated Weather Observing System (AWOS), U.S. Department of Transportation, 48 pp.

National Data Buoy Center, 1990: Coastal-Marine Automated Network (C-MAN) NWS Users Guide, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 81 pp.

National Weather Service, 1979: Training Guide in Aviation Weather Observations for SAWRS and LAWRS, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 81 pp.

_____, 1981: AMOS, RAMOS, and AUTOB Observations, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 42 pp.

_____, 1989a: AFOS Handbook No. 2, Vol. 1, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

_____, 1989b: AFOS Handbook No. 5, Vol. 6 Part 2, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

_____, 1992a: Guide to AFOS System Z, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 266 pp.

_____, 1992b: ASOS User's Guide, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 77 pp.

_____, 1992c: Federal Meteorological Handbook No. 1: Surface Aviation Observations (proposed), National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 156 pp.

_____, 1992d: ASOS Quick Reference Handbook, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, 45 pp.

OFCM, 1984: Aviation Weather Observations. Federal Meteorological Handbook No. 9, U.S. Departments of Commerce, Defense, and Transportation.

_____, 1988a: Surface Observations. Federal Meteorological Handbook No. 1, U.S. Departments of Commerce, Defense, and Transportation.

_____, 1988b: Surface Synoptic Codes. Federal Meteorological Handbook No. 2, U.S. Departments of Commerce, Defense, and Transportation.

Perrotti, H. P., 1984: AFOS Surface Observation Decoding. NOAA Techniques Development Laboratory Computer Program NWS TDL CP 84-2, National Weather Service, NOAA, U.S. Department of Commerce, 35 pp.

Scott, C. M., 1983: Controlling station spacing on regional SAO plots. Unpublished manuscript, Eastern Region Headquarters, National Weather Service, NOAA, U.S. Department of Commerce, 4 pp.

Sunkel, W. E., 1982: A Regional Weather Depiction Plot. Central Region Computer Programs and Problems NWS CRCP No. 6, National Weather Service, NOAA, U.S. Department of Commerce, 33 pp.

WMO, 1988: Manual on Codes, Vol. I [Supplement No. 2 (VII, 1991)], WMO No. 306, Geneva Switzerland.

6. PROGRAM INFORMATION AND PROCEDURES FOR INSTALLATION AND EXECUTION

SURFACE AIRWAYS OBSERVATION DECODER

PART A: PROGRAM INFORMATION and INSTALLATION PROCEDURE

PROGRAM NAME: SAODECII/PLTGEN/SAODUMP AAL ID: DBC007
Revision No.: 07.20

FUNCTION: Extracts specific surface aviation, buoy, ship, and Coast Guard observations from the AFOS database, decodes them into combination integer/ASCII records, stores these records as RDOS files (SAODATA and/or SAODATASUP), and optionally chains to program PLTGEN which generates an AFOS UGG plot file (NMCPLTSAO) or an analogous RDOS UGG plot file GP.

PROGRAM INFORMATION:

Development Programmer(s):

Richard D. Thomas Jr.
Herman P. Perrotti
Allan H. Rowell
Christine L. Alex
Harry R. Glahn
Robert A. Beasley

Location: Techniques Development Laboratory

Phone: 301-713-0056

Language: FORTRAN IV/Rev 5.57
MAC Assembler/Rev 6.30

Maintenance Programmer(s):

Robert A. Beasley

Location: Techniques Development Laboratory

Phone: 301-713-0056

Type: Overlay/Chain

Save file creation dates: SAODEC
(old name for SAO Decoder)

Original release/Revision 01.00	-	January 1981
TDL release/Revision 02.00	-	September 1983
TDL release/Revision 02.10	-	December 1983
TDL release/Revision 03.02	-	April 1984
TDL release/Revision 04.00	-	September 1984
TDL release/Revision 04.40	-	May 1986
TDL release/Revision 05.10	-	March 1988

Save file creation dates: SAOD1
(Second part of old SAO Decoder Package)

Original release/Revision 01.00	-	January 1981
TDL release/Revision 02.00	-	September 1983
TDL release/Revision 02.10	-	December 1983
TDL release/Revision 03.02	-	April 1984
TDL release/Revision 04.00	-	September 1984
TDL release/Revision 04.40	-	May 1986
TDL release/Revision 05.10	-	March 1988
TDL release/Revision 05.24	-	December 1988
TDL release/Revision 05.26	-	February 1989
TDL release/Revision 05.29	-	March 1989

Save file creation dates: SAODECII
(new Direct DataBase Access version)

TDL release/Revision 06.00 (released to Regional Scientific Services Divisions only (SSDs)	-	August 1990
TDL release/Revision 06.10 (released to SSD's only)	-	October 1990
TDL release/Revision 06.20 (released to SSD's only)	-	November 1990
TDL release/Revision 06.21 (released to SSD's only)	-	December 1990
TDL release/Revision 06.23 (released to SSD's only)	-	January 1991
TDL release/Revision 06.31	-	June 1991
TDL release/Revision 06.40	-	August 1991
TDL release/Revision 06.42	-	December 1991
TDL release/Revision 06.43	-	May 1992
TDL release/Revision 07.00	-	July 1992
TDL release/Revision 07.10	-	August 1992
TDL release/Revision 07.11	-	September 1992
TDL release/Revision 07.12	-	October 1992
TDL release/Revision 07.14	-	December 1992
TDL release/Revision 07.15	-	January 1993
TDL release/Revision 07.16	-	February 1993
TDL release/Revision 07.18	-	June 1993
TDL release/Revision 07.19	-	July 1993
TDL release/Revision 07.20	-	August 1993

Save file creation dates: PLTGEN

Original release/Revision 01.00	-	December 1980
TDL release/Revision 02.00	-	September 1983
TDL release/Revision 02.10	-	December 1983
TDL release/Revision 03.02	-	April 1984
TDL release/Revision 04.00	-	September 1984
TDL release/Revision 04.40	-	May 1986
TDL release/Revision 04.50	-	November 1990
TDL release/Revision 04.51	-	June 1991
TDL release/Revision 04.52	-	December 1991
TDL release/Revision 04.60	-	May 1992
TDL release/Revision 04.63	-	February 1993
TDL release/Revision 05.00	-	June 1993

Save file creation dates: SAODUMP

Original release/Revision 01.00	-	(unknown)
TDL release/Revision 2.00	-	September 1983

Approximate Running time SAODECII:
0.6 - 0.7 seconds per observation for > 200 observations.

Disk space:
Program files:

SAODECII.SV	-	93 RDOS blocks
SAODECII.OL	-	324 RDOS blocks
PLTGEN.SV	-	73 RDOS blocks
SAODUMP.SV	-	19 RDOS blocks

Data files:

CCCLIST.nn	-	(10 + (10 * n_{obs}))/512 RDOS blocks
SAOCLTVID.DT	-	(4 + (4 * $n_{xxx's}$))/512 RDOS blocks
SAOXXX	-	1 RDOS block
SAODATA	-	(10 + (96 * n_{obs}))/512 RDOS blocks
SAODATASUP	-	(10 + (192 *n_{obs}))/512 RDOS blocks
GP	-	(165 + (70 * n_{obs}))/512 RDOS blocks
WXDATA.bb	-	(16 + (12 * n_{obs}))/512 RDOS blocks
STDIR.MS	-	145 RDOS blocks

PROGRAM REQUIREMENTS

Program files:

NAME	COMMENTS
SAODECII.SV	Chains to PLTGEN when run without global "N" switch or with global "F" switch and to SAODUMP when run with global "X" switch.
PLTGEN.SV	Chains to SAODUMP when SAODECII is run with global "X" switch.
SAODUMP.SV	

Data files:

NAME	Disk location	READ/WRITE	COMMENTS
CCCLIST.nn	Master directory	R	Created by RDOS text editor.
SAOCLTVID.DT	Master directory	R	Created by RDOS text editor.
SAOXXX	Master directory	R/W	Created by SAODECII. Read by PLTGEN.
SAODATA	Master directory	R/W	Created by SAODECII. Read by PLTGEN.
SAODATASUP	Master directory	W	Created by SAODECII.
GP	Master directory	W	Created by PLTGEN when when global "F" switch is used.
WXDATA.XX	Master directory	W	Created by PLTGEN.
STDIR.MS	Master directory	R	Station Directory (DBC035) Read by PLTGEN.

AFOS Products:

ID	ACTION	COMMENTS
NMCPLTSAO	Stored	Output from SAODECII if run without the global "N" and/or global "F" switch(s).

LOAD LINE

SAODECII:

```
MAIN AREA ──►  RLDR/P/E SAODECII SAODECII/S SAODECII.LM/L 11/C ^
               SAOREV TIMPR INTGR INTGER BLKCHK STRING ^
               FRAC IFAH WMROF VAPFW INCHES SLSHCK BLANK POBS^
               AFSP AFSV AFSB DTRNGE ^
OVERLAY I  ──► [SAOINT SAOLST CNXALP CHGDT, RDSKEL RDK0 RDK1 ^
               RDK2 TYPREP, SAFV SAOBS SAFILT SAHEAD SAONE, ^
               MXFV MXOBS MXFILT MXHEAD, CGFV CGOBS CGFILT CGHEAD, ^
               BYFV BYOBS BYFILT BYHEAD, SHFV SHOBS SHFILT SHHEAD ^
               SYNVV SYNWX, INFV INOBS INFILT INHEAD] ^
OVERLAY II ──► [ONEOB SONOB BONOB CKCALL CK203 STNTYPE CRTIME DCMPR WMOV,
               SKY VSBYWX DECVIS WX BFILL, ^
               TEMPDP SLP WIND ALTIM DRSP REMARK CHKTYP, ^
               PRECIP CLOUD MAXMIN ICEL MB,
               GAPPRR GCLOUD GSMXMN GMAXMIN G24RAIN GSNOW NMAXMIN NPRECIP,
               GRS1 GRS2, WROBS] ^
LIBRARIES ──►  <BG UTIL FORT SYS AFOSE>.LB
```

PLTGEN:

```
RLDR/P/E PLTGEN PLTGEN/S PLTGEN.LM/L ^
CT MASC MSND BNSCH OUTPUT CART MERC TIMPRT WMOVIS ^
PIXIJ PWXSYM BLKCHK STRING INTGR INITAR SEARCH PGENREV ^
<BG UTIL FORT SYS AFOSE.LB PLTGEN.LM/L
```

PROGRAM INSTALLATION

1. Move the executable modules, SAODECII.SV, SAODECII.OL, and PLTGEN.SV to the master directory (usually SYSZ) or to an applications directory with links to the master directory. **Make sure** that you create proper links if you use an applications directory instead of the master directory. SAODUMP.SV should also be linked to the master directory.

2. Move the master CCCLIST.00 and the master SAO collective identifier list, SAOCLTVID.DT, to the master directory or to an applications directory with links to the master directory.

3. Edit the CCCLIST.nn to create a specific station decoding list(s) for your site. Note that CCCLIST.nn files used with **SAODEC** (i.e., prior to release 6.00 of SAODECII) are **not** compatible with any release of **SAODECII**. You may either create your own in accordance with the instructions in Appendix I, or you may modify the master CCCLIST.nn as illustrated in Fig. 6A.

4. If the STDIR.MS file does not already exist, obtain it from CRH's Scientific Services Division (SSD) of the NWS and move it to the master directory or to an applications directory with links to the master directory. See Appendix II for instructions on how to edit this file using the program SDEDIT.

5. If necessary, PILEDIT your database to add the AFOS product NMCPLTSAO.

4. **Make sure** that the AFOS database files LOCAL1DATA, LOCAL2DATA, LOCALDATA, and REMOTEDATA and the files SKEL and DATAKEY0, which should be located in the partition SYSA, are linked to the master directory.

SURFACE AIRWAYS OBSERVATION DECODER

PART B: PROGRAM EXECUTION and ERROR CONDITIONS

PROGRAM NAME: SAODECII/PLTGEN/SAODUMP AAL ID: DBC007
Revision No.: 07.20

PROGRAM EXECUTION:

1. Run SAODECII, which automatically chains to PLTGEN unless the global "N" switch is issued on the command line and the global "F" switch is not.

   At the DASHER enter:

   SAODECII/A/F/G/H/I/J/M/N/O/S/U/W/X/Y/Z
   bb/B nn/C mmddyy/D e/E l/L p/P bbbbeeee/R hhmm/T

   Definition of switches:

   (Note: While all of the switches listed below are used on the command line for SAODECII, many of the switches only affect the outcome of PLTGEN. The principal program affected by the use of each switch is denoted in brackets immediately following the definition of the switch).

   GLOBAL

   /A Append additional decoded observations to an existing SAODATA and/or SAODATASUP file. [SAODECII]

   /F Do not store the plot file in the AFOS database, instead store as an RDOS file called "GP". SAODECII will chain to PLTGEN when this switch is used regardless of whether or not the global "N" switch is used simultaneously. [PLTGEN]

   /G Prints decoded observations for all 96 words (SAODATASUP) on the PPM or a line printer (if available), using full formatted output for each station. (See Fig. 7.) [SAODECII]

   /H Plot the altimeter setting reduced to sea-level pressure (SLP) in millibars in lieu of the SLP, at stations where the SLP is not reported. This will result in a plot mixture of true SLP's and altimeter settings reduced to SLP. [PLTGEN]

   /I Plot station ID's below and to the left of the station circle. (Note: only the last 4 characters of a station ID are plotted. All drifting buoys are prefixed with the letter "D". (Also see the global "U" switch.) [PLTGEN]

   /J Rerun the program using an existing decoded data file (SAODATA). In this case the program will chain directly to PLTGEN. **No observations will be decoded**. [SAODECII]

/M Calculate the mixing ratio and include the result in the decoded observation. Mixing ratio cannot be plotted using PLTGEN/PMOD/GENUTF as it is not a part of the standard UGG plot file. Mixing ratio, however, can be obtained from printouts produced by using either or both of the global "G" and "X" switches. [SAODECII]

/N Do not create a plot file (i.e., do not chain to PLTGEN). Note that the global "F" switch will override the global "N" switch. [PLTGEN]

/O Address the AFOS product NMCPLTSAO, which contains the UGG plot file output by PLTGEN, to the local site ID found in the SKEL file. This allows local asynchronous transmission of the plot file. [PLTGEN]

/S **Specials** (if found) **will be included** in the decoded data set. [SAODECII]

/U Allows for duplicate decoding of ship, buoy, and C-MAN observations which are non-unique within the last four characters of their ID, regardless of whether these observations are within the same version of the collective or a previous version of the collective. This is useful since some bonafide different ship, buoy, and C-MAN observations would normally not be decoded when the last four characters of their ID are identical to the last four letters of a previously decoded ship, buoy, or C-MAN station. Essentially the global switch "U" skips the duplicate call check routine. [SAODECII]

/W Create a plot file WXDATA.bb compatible with the weather depiction plot program WXPLOT. The RDOS extension "bb" denotes the associated map background. [PLTGEN]

/X Prints program diagnostic information on the DASHER. SAODECII will chain to the program SAODUMP, which prints formatted data from the SAODATA file when this switch is used, regardless of whether or not the global "N" switch is used. [SAODECII]

/Y Decodes all versions of SAO's available in the database for the specified decoding time interval. This switch does not apply to SAO's transmitted in collectives or to other types of observations. [SAODECII]

/Z Set all zoom settings to zero (ratio of 1:1 on GDM). (Note: moored and drifting buoys will always have a zoom setting of zero as they are not resident in the STDIR.MS file. [PLTGEN]

LOCAL

bb/B = Map background number for which a plot file is to be generated. [PLTGEN]

nn/C = Extension (.nn) of CCCLIST.nn file which designates the specific list of observations to be decoded by SAODECII. [SAODECII]

mmddyy/D = Month, day, and year which will be used to set the anchor time of the decoding interval. [SAODECII]

e/E = Determines whether or not the supplementary SAODATASUP file (96 words per observation) will be created and/or the standard SAODATA file (48 words per observation). [SAODECII]

l/L = Lists information about decoded and non-decoded observations on the DASHER. [SAODECII]

p/P = Single element display plot parameter (see Table 1). [PLTGEN]

bbbbeeee/R = Decode observations that have an AFOS creation time of hhmm-bbbb (hhmm is hour/minutes and bbbb is in minutes) and hhmm+eeee (eeee is in minutes), where hhmm denotes the integer truncated anchor time either by system default or that specified through the local "T" switch. [SAODECII]

hhmm/T = Observations will be decoded for the time range hhmm+30 through hhmm-30, where hhmm is hour/minutes. (Note: "hhmm" is an integer truncated time. Thus, the use of the local "T" switch as "1959/T" or running SAODECII at a system time of 1959Z will both result in an actual decoding window based on 1900Z, not 1959Z and not 2000Z. [SAODECII]

Defaults (Switch not used):

Global

/A = Do not append additional data to an existing SAODATA and/or SAODATASUP file.

/F = Store the plot file NMCPLTSAO in the database.

/G = Do not print formatted decoded observations on the PPM or line printer.

/H = Do not convert altimeter setting to millibars at stations where the SLP is not given.

/I = Do not plot station ID's.

/J = Decode a new set of observations.

/M = No mixing ratio calculation is made.

/N = Create a plot file (NMCPLTSAO, or the analogous RDOS plot file "GP" - see global "F" switch).

/O = AFOS product NMCPLTSAO is addressed to "000".

/S = Special observations are not decoded.

/U = Do not decode ship, buoy, and C-MAN stations which are non-unique within the last four characters of their station identifier.

/W = Do not create a weather depiction compatible plot file WXPLOT.bb.

/X = No diagnostic print and no chain to the program SAODUMP.

/Y = Only one observation will be decoded for each station. It should be noted that this will always be the most current observation in the decoding interval.

/Z = Zoom level will be read from the STDIR.MS file. If the observation includes its latitude and longitude, then the zoom setting will still be set to zero (ratio of 1:1 on the GDM).

Local

/B = B02 map background is used.

/C = CCCLIST.nn (nn is any combination of the numbers 0-9 and the letters A-Z).

/D = Current system date is used.

/E = Only the standard 48-word SAODATA file is created.

/L = Do not print the status of decoded and non-decoded observations on the Dasher.

/P = All parameters are plotted with SLP (when available).

/R = Decode observations for a 1-hour interval, 30 minutes either side of the current integer truncated system time or the integer truncated time specified through the local "T" switch.

/T = Decoding interval anchor time is based on the current integer truncated system time.

Options:

bb/B: bb = Any valid AFOS map background number. However, PLTGEN expects the map background to be derived from either B01, B02, or B03.

e/E: e =
- 0 - Create only the standard 48-word SAODATA file.
- 1 - Create both the standard 48-word SAODATA file and the supplementary 96-word SAODATASUP file.
- 2 - Create only the supplementary 96-word SAODATASUP file.

l/L: l =
- 0 - Do not list information about decoded/non-decoded observations on the Dasher.
- 1 - Only list information about decoded observations on the Dasher.
- 2 - Only list information about non-decoded observations on the Dasher.
- 3 - List information about both decoded and non-decoded observations on the Dasher.

p/P:
- Q = All parameters are plotted with the SLP (mb) at stations where the SLP is available.
- B = All parameters are plotted with altimeter setting (inches of Hg).
- A = Only the altimeter setting is plotted.*
- P = Only the SLP is plotted.*
- T = Only the temperature is plotted.*
- D = Only the dewpoint is plotted.*
- C = Only the pressure tendency is plotted.*
- W = Only the wind barbs and sky cover are plotted.

*Note: All single parameter plots include wind barbs and sky cover in addition to the indicated element.

2. Certain combinations of switches are meaningless and should be avoided, such as global "F" and global "N", or global "W" and global "N", etc... The global "F" and "W" switches will always override the global "N" switch. Another combination that should certainly be avoided is the global "W" switch with the local "P" switch. Visibility will not be plotted by WXPLOT when the local "p/P" switch has been used with p = A, P, T, D, C, or W.

3. Before executing the program a station decoding list (CCCLIST.nn) must be established. The CCCLIST.nn essentially contains a list of all AFOS keys that you wish to decode. You can establish as many CCCLIST's as you like. Simply specify the desired CCCLIST.nn with the local "C" switch. See Appendix I for more information on using and designing CCCLIST's. A master CCCLIST.00 has been provided with the SAODECII software package and is also illustrated in Fig. 6A.

4. It is also necessary to have an SAO collective identifier list (SAOCLTVID.DT) for SAO's which are sent in collectives. A master SAOCLTVID.DT list has been provided with the SAODECII software package and is also illustrated in Fig. 6B.

3. To create a synoptic graphics display from the plot file (NMCPLTSAO) or the equivalent RDOS file GP, generated by PLTGEN, run one of the graphics generation programs such as REGPLOT or PMOD from a macro. For more information on creating graphics from the decoded data of SAODECII see Appendix III.

4. It is absolutely mandatory that the AFOS database files LOCAL1DATA, LOCAL2DATA, LOCALDATA, REMOTEDATA, SKEL, and DATAKEY0 must either reside in, or be linked to the directory in which the SAO Decoder is located. In addition, the CCCLIST(s) must also reside in or be linked to the directory in which the SAO Decoder is located. Furthermore, PLTGEN.SV and SAODUMP.SV must also either reside in or be linked to the directory in which the SAO Decoder is located. See Appendix VI for a list of error conditions.

Table 1. The contents, default settings, and definitions of the data stored in the SAOXXX File. The main purpose of this file is to pass certain information to PLTGEN. Note that elements 9-13 are interdependent. For WXPLOT to plot visibility, elements 10-13 must be 1, 1, 0, and 1 respectively. This will only be true when the local "P" switch is not used, or when used only as "Q/P" or "P/P". Also, note that all plots contain wind barbs and sky cover. Using the local "W/P" switch includes only wind barbs and sky cover.

Word Number	Default	Definition
1	system month	Month of the year used as the anchor time of the decoding interval.
2	system day	Day of the month used as the anchor time of the decoding interval.
3	system year	Year used as the anchor time of the decoding interval.
4	system integer truncated time	Universal Coordinated Time (UTC) used as the anchor time of the decoding interval.
5	1	0 = Decode the most recent specials. 1 = Do not decode specials
6	02	Map background.
7-8	00	File extension (nn) of CCCLIST.nn.
9	1	1 = Plot pressure; 0 = No plot of pressure.
1Ø	1	1 = Plot temperature; 0 = No plot of temperature.
11	1	1 = Plot dewpoint; 0 = No plot of dewpoint.
12	0	0 or 1 while 10, 11, & 13 = 0; Plot wind barbs and sky cover.
13	1	1 = Plot pressure tendency; Do not plot pressure tendency.
14	0	1 = Create a weather depiction plot file WXPLOT.bb; 0 = Do not create a weather depiction plot file.
15	0	1 = Plot all observations at 1:1 zoom setting; (drifting and moored buoys will always be plotted at 1:1 zoom setting); 0 = Zoom settings are read from the STDIR.MS file.
16	30	Upper range (minutes) for decoding interval.
17	30	Lower range (minutes) for decoding interval.
18	0	1 = Plot station ID's; 0 = Do not plot station ID's.
19	0	0 = SAODECII will chain to PLTGEN and store plot file in AFOS database as NMCPLTSAO; 1 = Do not chain to PLTGEN; 2 = Chain to PLTGEN but NMCPLTSAO is stored instead as an RDOS file "GP".

Table 1. (continued)

Word Number	Default	Definition
20	0	1 = Calculate mixing ratio; 0 = Do not calculate mixing ratio.
21	0	1 = Print certain diagnostic information on the line printer/PPM and the Dasher; 0 = Do not print diagnostic information.
22	0	1 = Append decoded data to an existing SAODATA and/or SAODATASUP file; 0 = Do not append data to SAODATA and/or SAODATASUP.
23	0	1 = Convert altimeter settings to SLP at stations where the SLP is not given; 0 = Do not convert altimeter settings to SLP.
24	0	1 = Chain to PLTGEN immediately - use an existing SAODATA file; 0 = Do not chain immediately to PLTGEN, instead decode observations as normal.
25	0	0 = Plot product "NMCPLTSAO" is addressed to "000"; 1 = plot product "NMCPLTSAO" is addressed to local ID found in SKEL file.

Table 2. Format of the SAODATA and SAODATASUP file. Note that the data for the first decoded observation really begins with word 5, as there are 4 words of preamble to the SAODATA and SAODATASUP files, namely month, day, year, and time respectively. Therefore, you should always add 4 to the number given below in the left hand column labeled "Word Number" to get the true word number. The last word of the SAODATA and SAODATASUP files is always an end of transmission indicator (ETX - octal 203 in the left half of the word).

Word Number	Contents	Variable Type	Default
1-2	Station call letters. *(4 letters max.)*	Packed ASCII	blank
3	Return code. *(see Table 3.)*	Integer	-99
4	Decoding interval anchor time (UTC).	Integer	-99
5	Standard observation type. *(see Table 4.)*	Integer	-99
6	Latitude in tenths of degrees.	Integer	-99
7	Longitude in tenths of degrees.	Integer	-99
8	**LAND STATIONS:** Squall Indicator (ASCII Q)	Unpacked ASCII	-99
	MARINE STATIONS: Coded ships speed and direction. *(see FMH No. 2 pg. 5-1)*	Integer	-99
9	Amount of clouds in highest cloud layer. *(see Table 5.)*	Unpacked ASCII	blank
10	Thin/variable flag for the highest cloud layer. *(see Table 6.)*	Integer	0
11	Height in 1ØØ's of feet of the highest cloud layer.	Integer	0
12	**LAND STATIONS:** Ceiling indicator of the highest cloud layer. *(see Table 7.)*	Unpacked ASCII	blank
	MARINE STATIONS: Swell direction.	Packed ASCII	blank
13	Amount of clouds in second highest cloud layer. *(see Table 5.)*	Unpacked ASCII	blank
14	**LAND STATIONS:** Thin/variable flag for the second highest cloud layer. *(see Table 6.)*	Integer	0
	MARINE STATIONS: Wave period in seconds.	Packed ASCII	blank
15	Height in 100's of feet of the second highest cloud layer.	Integer	0
16	**LAND STATIONS:** Ceiling indicator of the second highest cloud layer. *(see Table 7).*	Unpacked ASCII	blank
	MARINE STATIONS: Swell period in seconds.	Packed ASCII	blank
17	Amount of clouds in third highest cloud layer. *(see Table 5).*	Unpacked ASCII	blank
18	**LAND STATIONS:** Thin/variable flag for the third highest cloud layer. *(see Table 6).*	Integer	0
	MARINE STATIONS: Wave height in half-meters.	Packed ASCII	blank
19	Height in 100's of feet of the third highest cloud layer.	Integer	0

Table 2. (continued)

Word Number	Contents	Variable Type	Default
20	**LAND STATIONS:** Ceiling indicator of the third highest cloud layer. *(see Table 7).*	Unpacked ASCII	blank
	MARINE STATIONS: Swell height in half-meters.	Packed ASCII	blank
21	Visibility: Positive = miles; Negative = thousandths of miles.	Integer	-99
22	Variable visibility indicator ("V").	Unpacked ASCII	blank
23-27	Obstructions to vision (right justified).	Packed ASCII	blank
28	Sea level pressure in tenths of millibars.	Integer	-99
29	Temperature in degrees Fahrenheit.	Integer	-99
30	Dew point in degrees Fahrenheit.	Integer	-99
31	Mixing ratio in tenths of grams/kilogram.	Integer	-99
32	Wind direction tenths of whole degrees.	Integer	-99
33	Wind speed in knots.	Integer	-99
34	Wind gusts or squalls in knots.	Integer	-99
35	Altimeter setting in hundredths of inches of mercury (Hg).	Integer	-99
36	Temperature in degrees Celsius.	Integer	-99
37	Dew point in degrees Celsius.	Integer	-99
38-40	Visibility (left justified)	Packed ASCII	blank
41	Pressure tendency characteristic. *(See FMH No. 2 pg. 4-12, 1988)*	Integer	-99
42	Pressure tendency in hundredths of millibars.	Integer	-99
43	6 hour precipitation amount in hundredths of inches to 99.9 inches. (Trace denoted as "-2".)	Integer	-99
44	Low cloud type. *(See FMH No. 2 pg. 4-38, 1988)*	Unpacked ASCII	blank
45	Middle cloud type. *(See FMH No. 2 pg. 4-41, 1988)*	Unpacked ASCII	blank
46	High cloud type. *(See FMH No. 2 pg. 4-44, 1988)*	Unpacked ASCII	blank
47	Maximum or minimum temperature value. Actual value depends on the type of station and the time of day.	Integer	-99
48	**LAND STATIONS:** Snow depth in inches.	Integer	0
	MARINE STATIONS: Sea surface temperature in degrees Fahrenheit.	Integer	-99

Table 2. (continued)

Word Number	Contents	Variable Type	Default
	***** NOTE: VALUES BELOW ARE FOR THE SAODATASUP FILE ONLY. *****		
49	Sea surface temperature in degrees Centigrade.	Integer	-99
50	Wave period in seconds.	Integer	-99
51	Wave height in half-meters. *(High resolution wave height is used if available)*	Integer	-99
52	Swell direction in degrees.	Integer	-99
53	Swell period in seconds.	Integer	-99
54	Swell height in half-meters.	Integer	-99
55	Minutes of sunshine. (only reported at 07Z or 08Z).	Integer	-99
56	ASOS 6-hour minimum temperature in degrees Fahrenheit.	Integer	-99
57	ASOS 6-hour maximum temperature in degrees Fahrenheit.	Integer	-99
58	ASOS calendar day minimum temperature in degrees Fahrenheit.	Integer	-99
59	ASOS calendar day maximum temperature in degrees Fahrenheit.	Integer	-99
60	24-hour rainfall amount in inches. (only reported at 12Z).	Integer	-99
61	ASOS hourly precipitation amount in inches.	Integer	-99
62	AMOS/RAMOS rain counter value.	Integer	-99
63	Peak wind direction in degrees.	Integer	-99
64	Peak wind speed in knots.	Integer	-99
65	Extended station and observation type. *(see Table 8)*.	Integer	-99
66	Cloud amount indicator of the lowest cloud layer. *"CLR BLO XXX" is interpreted as "U" instead of "C". (see Table 5).*	Integer	-99
67	AFOS product creation month.	Integer	-99
68	AFOS product creation day.	Integer	-99
69	AFOS product creation hour.	Integer	-99
70	AFOS product creation minutes.	Integer	-99
71-96	Blank words for possible future expansion.	Integer	-99

Table 3. Return codes and their definition reported in word three (for each decoded observation) of the SAODATA/SAODATASUP file. One of these return codes must be met in order for the station's decoded data to be written to SAODATA/SAODATASUP.

Return Code	Definition
1	Observation successfully decoded.
4	Observation type could not be identified.
5	Observation time could not be identified.
71	Coast Guard observation successfully decoded.
86	Buoy or C-MAN observation successfully decoded.
91	Ship observation includes present weather.
96	Ship observation successfully decoded.

Table 4. Standard observation types for SAO's only (word 5 of the SAODATA/SAODATASUP file for each decoded observation).

Value	Definition
0	Unknown
1	Manual record observation (SA)
2	Manual record special (RS)
3	Manual special observation (SP) or Urgent Special Observation (USP)
4	Unaugmented ASOS/AMOS/RAMOS/AUTOB/AUTO#
5	Augmented ASOS/AMOS/RAMOS/AUTOB/AUTO#
6	AWOS (FAA)
7	SAWR, LAWR, or local (L) observation
8	Corrected SA
9	Corrected RS
10	Corrected SP
11	Corrected unmanned AMOS/RAMOS/AUTO
12	Corrected manned AMOS/RAMOS
13	Corrected AWOS
14	Corrected SAWR, LAWR or L

Table 5. Cloud amount indicator. "XXX" denotes the cloud height in hundreds of feet (words 9, 13, 17, and 66 of the SAODATA/SAODATASUP file for each decoded observation).

Value	Definition
C	Clear (CLR)
S	Scattered (SCT)
B	Broken (BKN)
O	Overcast (OVC)
X	Obscured (X)
C	CLR BLO XXX in word 9, 13, or 17.
U	CLR BLO XXX in word 66.

Table 6. Thin or variable cloud layer indicator (words 10, 14, and 18 of the SAODATA/SAODATASUP file for each decoded observation).

Value	Definition
0	Default
1	Thin or partial
50	Variable ceiling height
51	Thin variable

Table 7. Ceiling indicator (words 12, 16, and 20 of the SAODATA/SAODATASUP file for each decoded observation).

Value	Definition
blank	Default
M	Measured
E	Estimated
W	Obscured (indefinite)
A	Canadian AUTO Identifier - set to W
B	Canadian AUTO Identifier - set to W
P	Canadian AUTO Identifier - set to W

Table 8. Extended observation types for SAO's only (word 65 of the SAODATASUP file). The value given under word 65 is a three-digit integer S_1S_2O as defined below.

Values for S_1 (major station type):
- 1 = manual U.S.
- 2 = ASOS.
- 3 = AWOS
- 4 = AMOS/RAMOS/AUTOB
- 5 = SAWR/LAWR
- 6 = Canadian
- 7 = Mexican

Values for S_2 (station subtype):

When S_1 = 1, S_2 = 1 always (manual).

When S_1 = 2, S_2 = 1 for ASOS type A01;
S_2 = 2 for ASOS type A01A;
S_2 = 3 for ASOS type A02;
S_2 = 4 for ASOS type A02A.

When S_1 = 3, S_2 = 1 always (AWOS).

When S_1 = 4, S_2 = 1 for unmanned AMOS;
S_2 = 2 for manned AMOS;
S_2 = 3 for unmanned RAMOS;
S_2 = 4 for manned RAMOS;
S_2 = 5 for unmanned AUTOB;
S_2 = 6 for manned AUTOB.

When S_1 = 5, S_2 = 1 for SAWR;
S_2 = 2 for LAWR.

When S_1 = 6, S_2 = 1 for Canadian manual;
S_2 = 2 for Canadian AUTO#.

When S_1 = 7, S_2 = 1 always (manual).

Values for O (observation type):
- 1 = record observation (SA).
- 2 = record special observation (SP).
- 3 = special observation (SP).
- 4 = urgent special observation (USP).
- 6 = corrected record observation (COR SA).
- 7 = corrected record special observation (COR RS).
- 8 = corrected special observation (COR SP).
- 9 = corrected urgent special observation (COR USP).

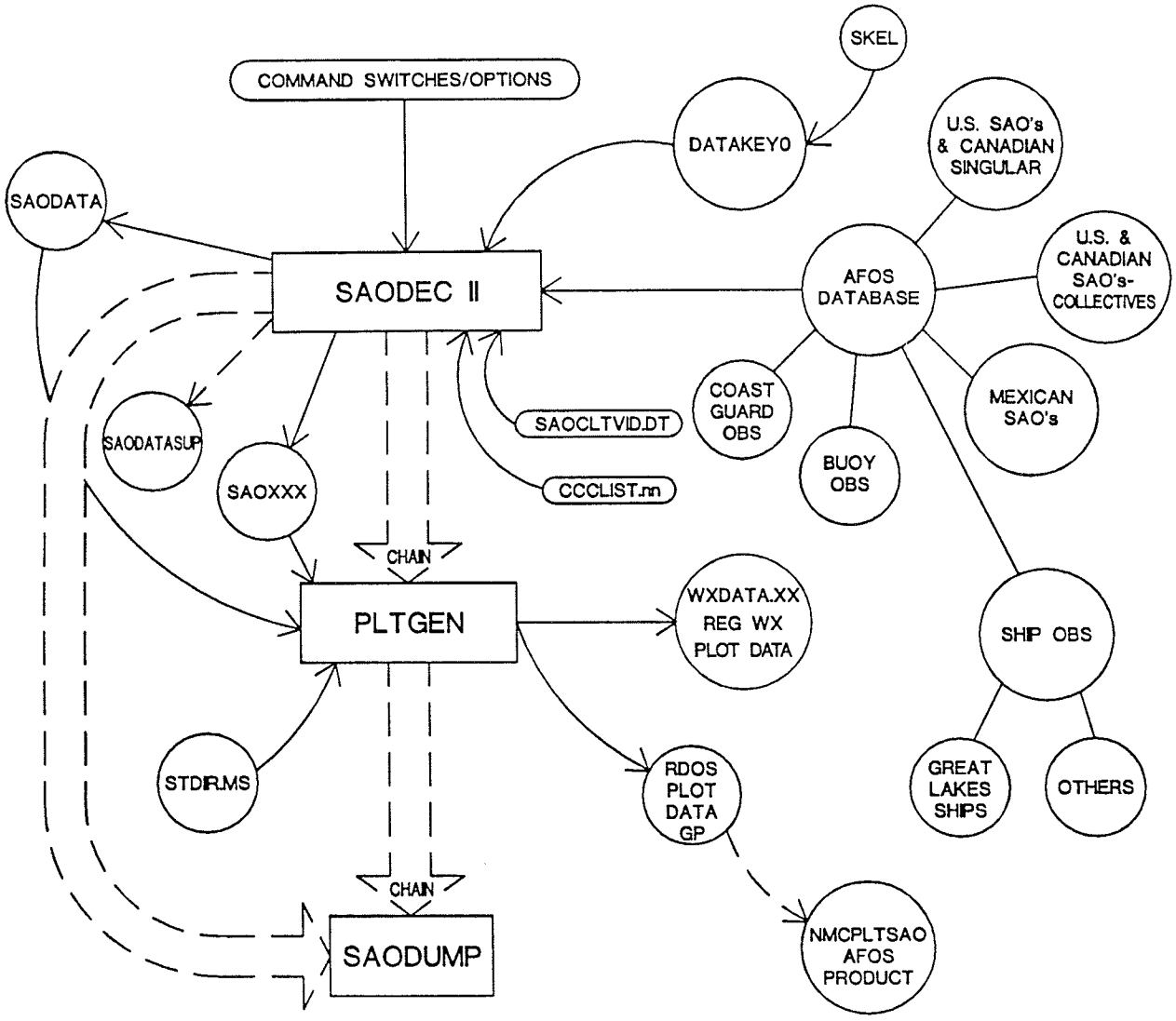
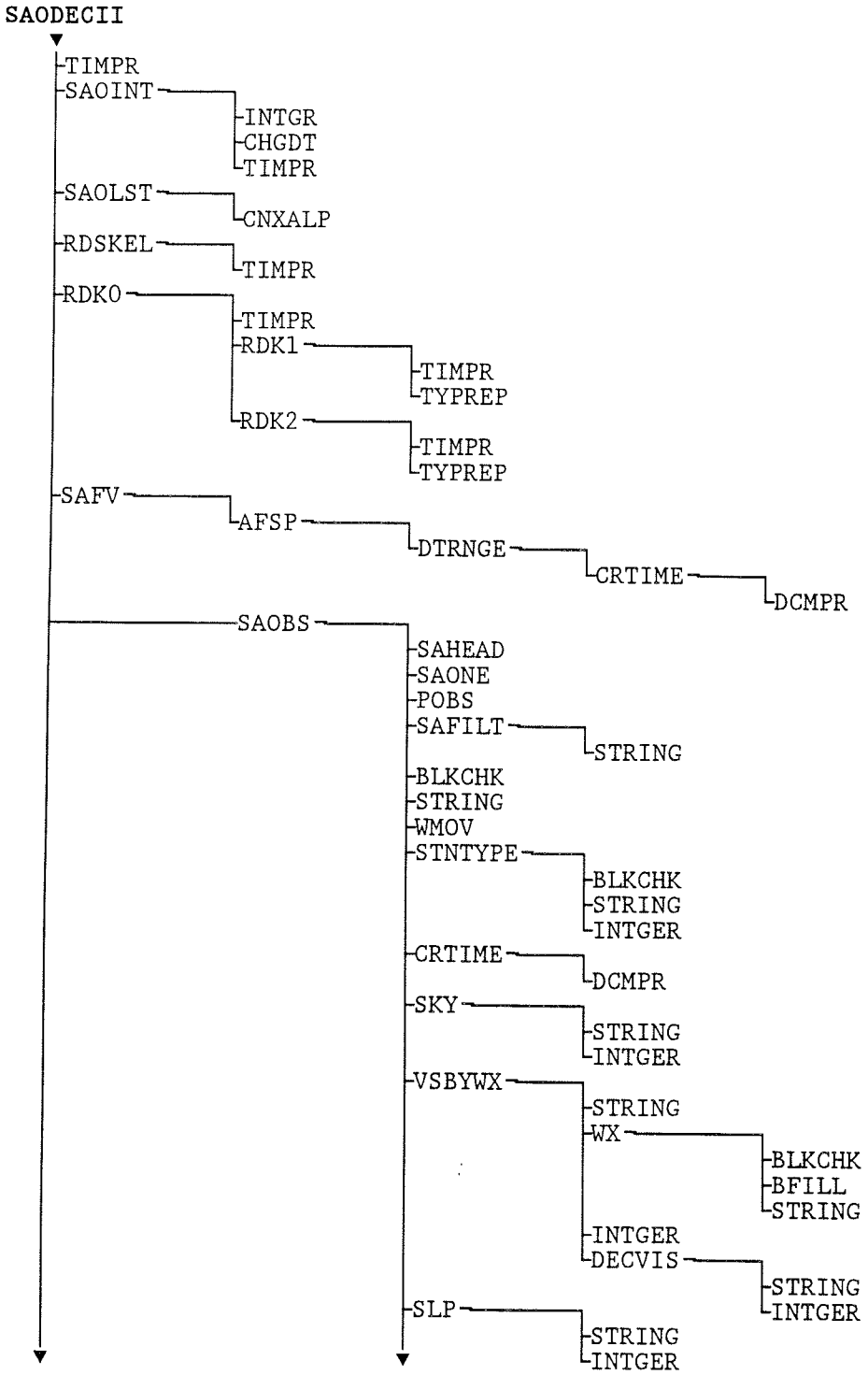


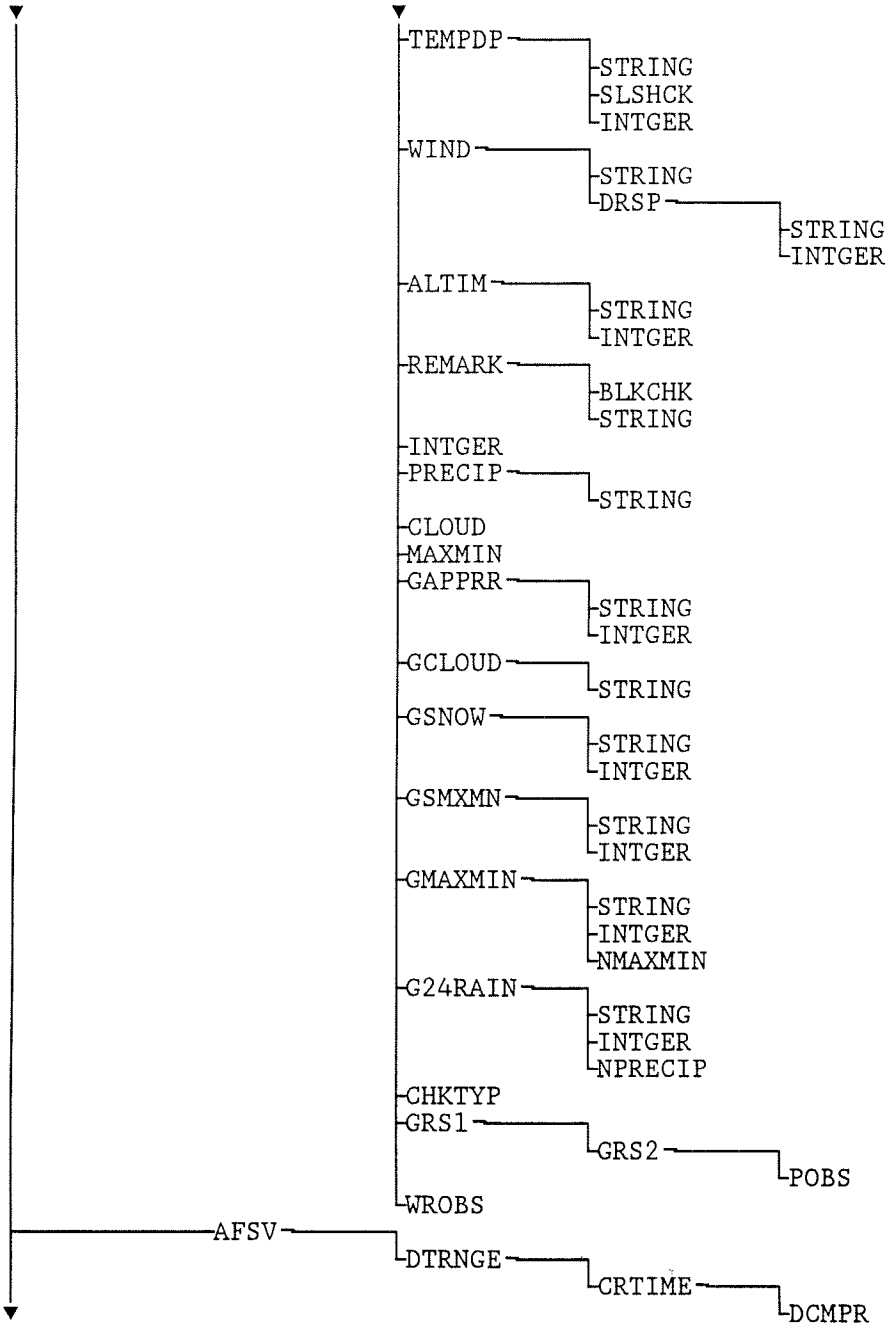
Figure 1. Data flow and program relationships for SAODECII and PLTGEN. Program tasks are designated by boxes and AFOS and RDOS disk files by circles. Ovals denote optional user command input. The dashed lines represent alternative links. Large arrows represent program module logical flow.

SAODECII and PLTGEN Program Structure

(Figure 2: Main module and module SAFV which is used to decode U.S. and Canadian SAO's where only one observation is transmitted per AFOS key. Note, flow is bidirectional along paths.)



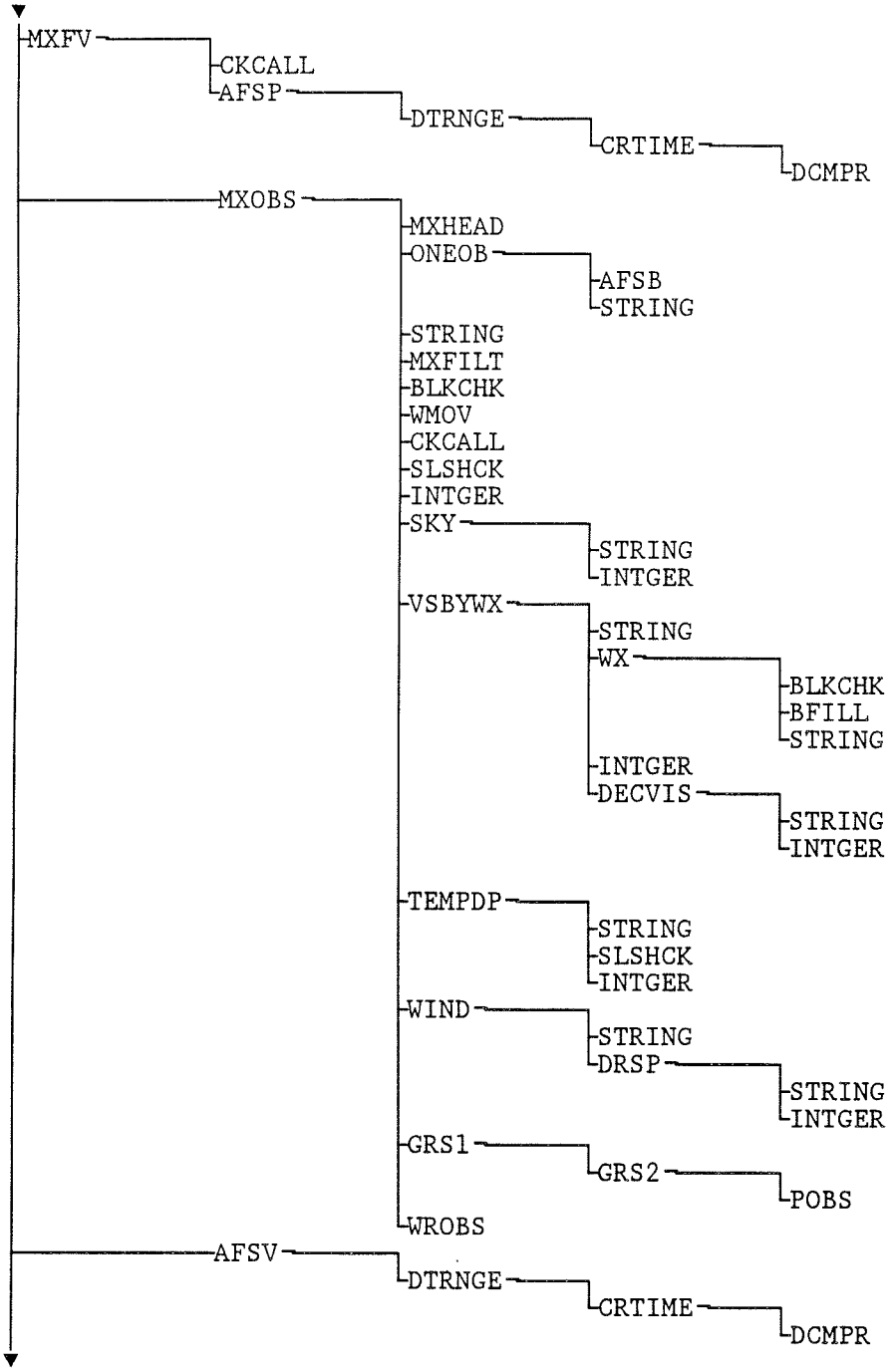
(Figure 2 continued)
(Module SAFV continued)



(end of module SAFV)

(Figure 2 continued)

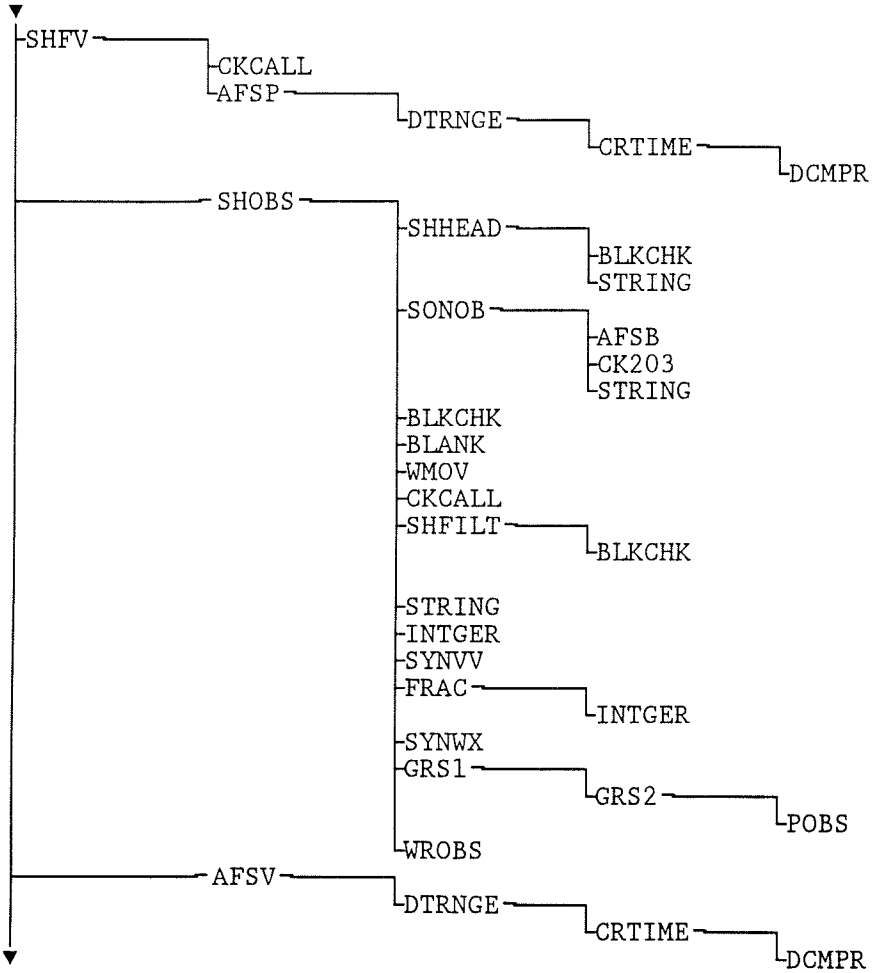
(Module MXFV which is used to decode Mexican SAO's which are transmitted in collectives).



(end of module MXFV)

(Figure 2 continued)

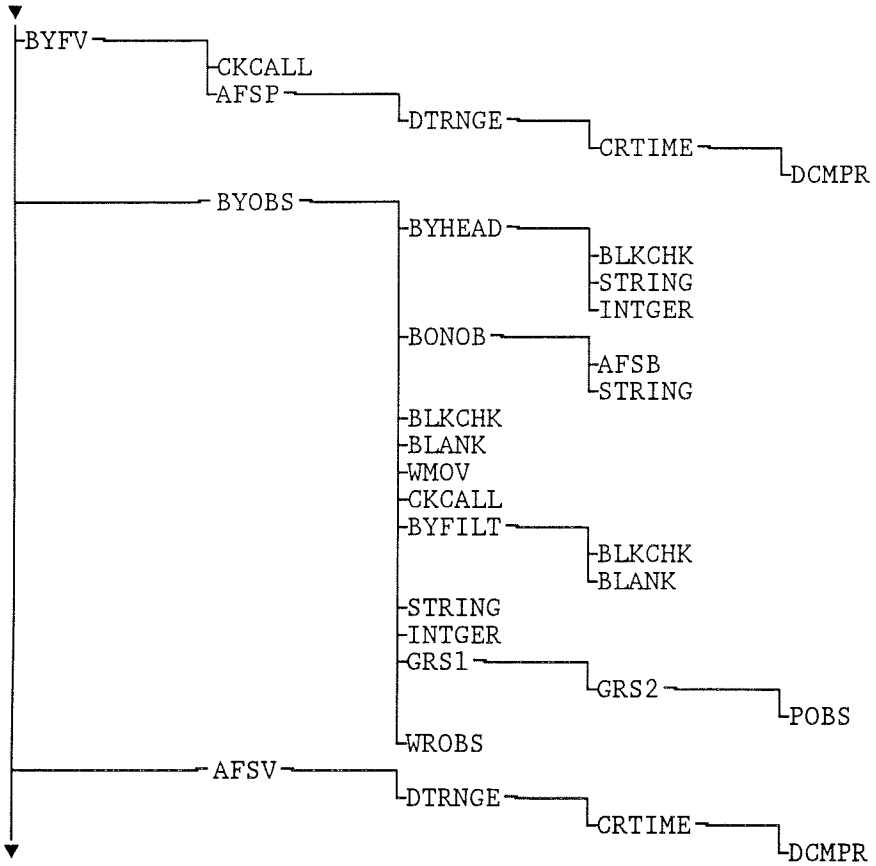
(Module SHFV used to decode ship observations which are transmitted in collectives).



(end of module SHFV)

(Figure 2 continued)

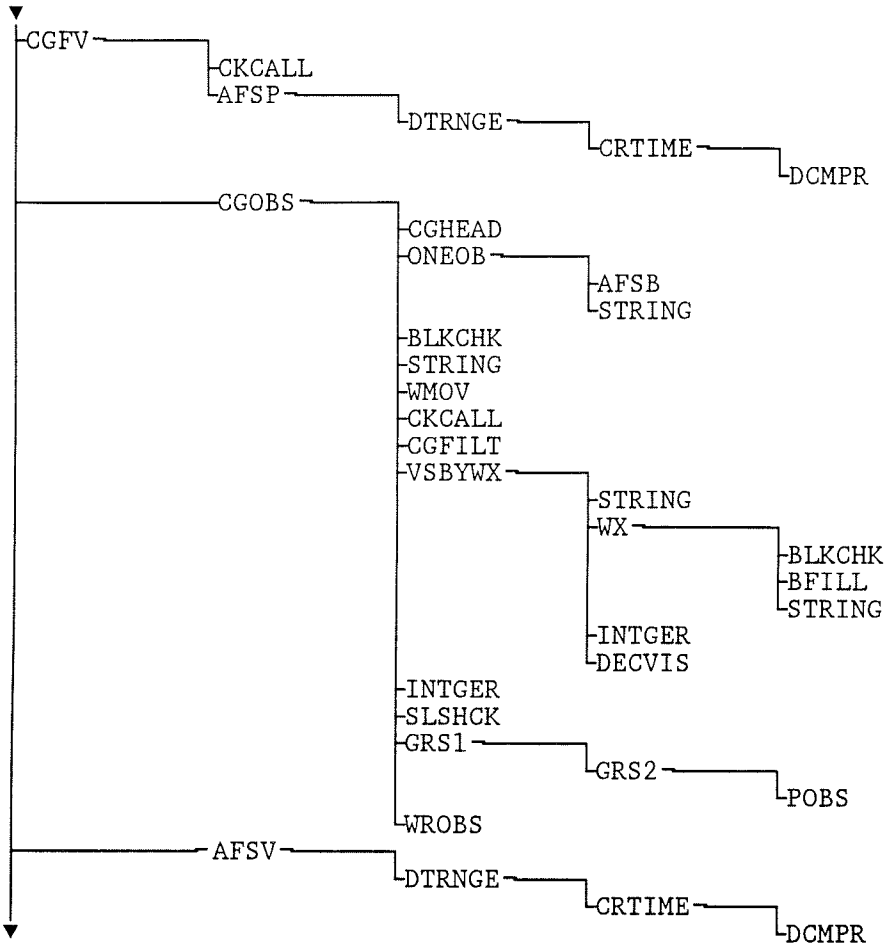
(Module BYFV used to decode moored, coastal marine, and drifting buoy reports in collectives)



(end of module BYFV)

(Figure 2 continued)

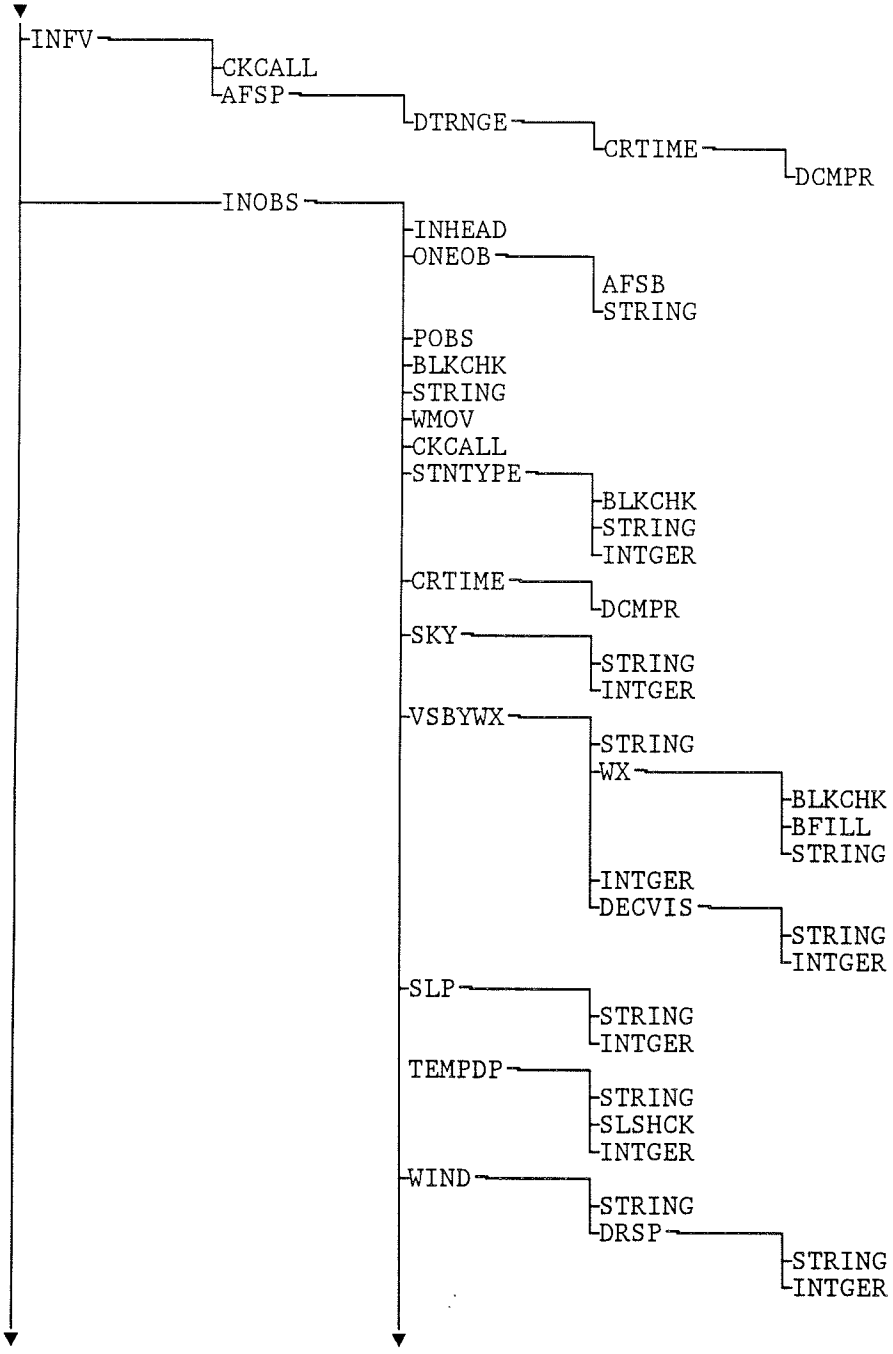
(Module CGFV used to decode Coast Guard observations in collectives)



(end of module CGFV)

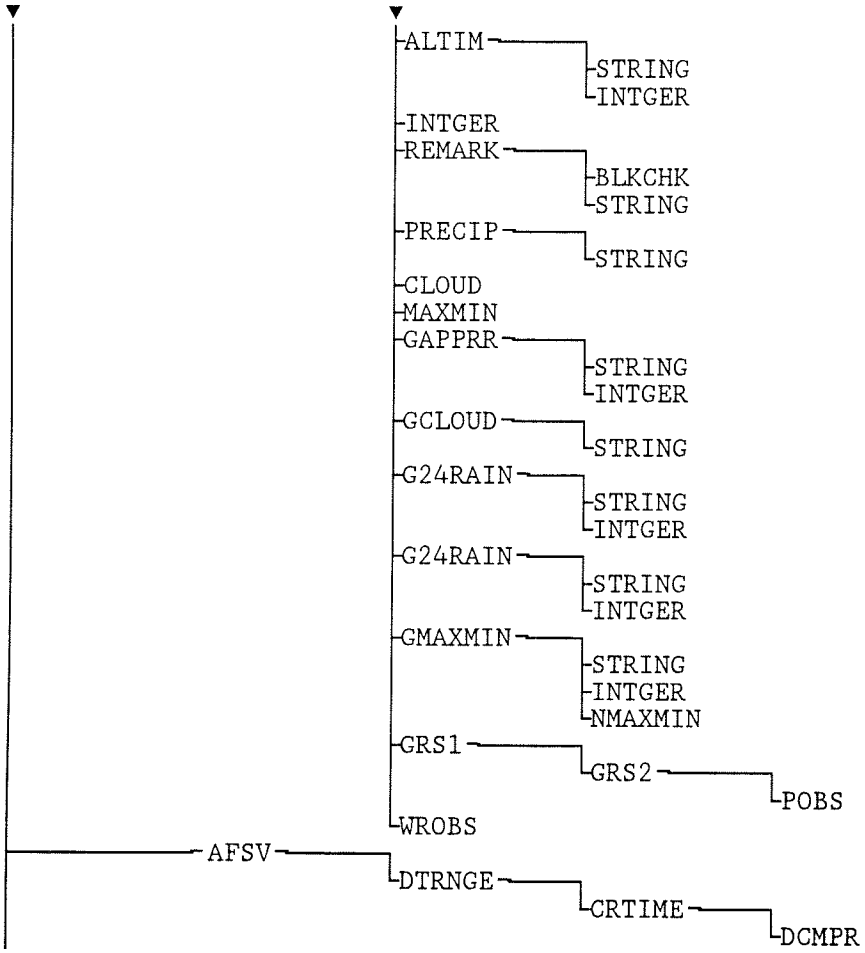
(Figure 2 continued)

(Module INFV used to decode SAO's transmitted in collectives)



(Figure 2 continued)

(Module INFV continued)



(End of module INFV)

(Figure 2 continued)

Software Structure for PLTGEN:

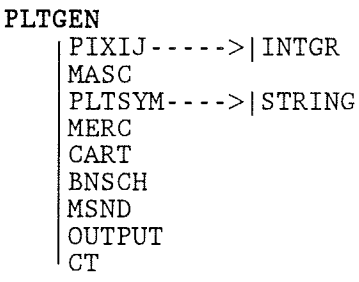


Figure 2. Software structure for programs SAODECII and PLTGEN.

```
    WORD
    ┌──┐
 0 000014 000013 000132 003720 000000 000003 000124 000063 .....Z.P.....T.3
10 000001 000001 000001 000000 000001 000001 000001 000132 ...............Z
20 000132 000001 000002 000001 000001 000000 000000 000000 ................
30 000003 ------ ------ ------ ------ ------ ------ ------ ................
```

Figure 3. An octal dump of the SAOXXX file as it would be displayed by the RDOS utility program, FPRINT. SAOXXX contains 25 words of command line information. See Table 1 for an explanation of each word above. The right portion of the print indicates the ASCII representation of the octal data printed on the left.

```
    ┌──────PREAMBLE──────┐                                          ┌ASCII PRINT┐
 0 000014 000013 000132 003720 046111 052040 000001 003642 .....Z.PLIT ..."
10 000001 177635 177365 177635 000123 000000 000372 000040 .........S.....
20 000123 000000 000226 000040 000123 000000 000050 000040 .S..... .S...(.
30 000024 000040 020040 020040 020040 020040 020040 023711 ...            'I
40 000100 000040 000046 000346 000013 177635 005677 000022 .@. .&.......?..
50 000000 031060 020040 020040 177635 177635 177635 000040 ..20    .......
60 000040 000040 177635 000000 001400 ------ ------ ------ . . ............
                              │ETX│
```

Figure 4. An octal dump of the standard (48 word per observation) SAODATA file for one observation. The first four words of the SAODATA file are always a preamble of the month, day, year, and time for the decoding anchor time. The last word of the SAODATA file is always an octal 203 [end of transmission (ETX) indicator] in the left half of the word. The remaining 48 words in between represent the decoded observation (in this case for Little Rock, AR). The right portion of the print indicates the ASCII representation of the octal data printed on the left. The definition of each word was previously given in Table 2.

```
    ┌──────PREAMBLE──────┐                                          ┌ASCII PRINT┐
  0 000014 000013 000132 003720 046111 052040 000001 003642 .....Z.PLIT ..."
 10 000001 177635 177365 177635 000123 000000 000372 000040 .........S.....
 20 000123 000000 000226 000040 000123 000050 000040 .S..... .S...(.
 30 000024 000040 020040 020040 020040 020040 200040 023711 ...            'I
 40 000100 000040 000046 000346 000013 177635 005677 000022 .@. .&.......?..
 50 000000 031060 020040 020040 177635 177635 177635 000040 ..20    ........
 60 000040 000040 177635 000000 000000 177635 177365 177635 . . ............
 70 177635 177635 177635 177635 177635 177635 177635 177635 ................
    ***
140 177635 177635 177635 177635 101400 ------ ------ ------ ................
                              │ETX│
```

Figure 5. An octal dump of the supplementary (96 word per observation) SAODATASUP file for one observation. The first four words of the SAODATASUP file are always a preamble of the month, day, year, and time for the anchor time of the decoding window. The last word of the SAODATASUP file is always an octal 203 (ETX) in the left half of the word. The remaining 96 words in between represent the decoded observation (in this case for Little Rock, AR). The right portion of the print indicates the ASCII representation of the octal data printed on the left. The definition of each word was previously given in Table 2.

```
^^^BOY^^^
^^^CGR^^^
^^^LAW^^^
^^^SHI^^^
^^^SHN^^^
^^^SHP^^^
ABQSAO^^^
ALBSAO^^^
ANCSAO^^^
ARBSAO^^^
ATLSAO^^^
BHMSAO^^^
BISSAO^^^
BOISAO^^^
BOSSAO^^^
BUFSAO^^^
CAESAO^^^
CHISAO^^^
CLESAO^^^
CRWSAO^^^
CYSSAO^^^
DENSAO^^^
DSMSAO^^^
FAISAO^^^
FSDSAO^^^
FTWSAO^^^
GTFSAO^^^
HNLSAO^^^
INDSAO^^^
JANSAO^^^
JNUSAO^^^
LAXSAO^^^
LBBSAO^^^
LITSAO^^^
MEMSAO^^^
MIASAO^^^
MKCSAO^^^
MKESAO^^^
MSPSAO^^^
NEWSAO^^^
NYCSAO^^^
OKCSAO^^^
OMASAO^^^
PDXSAO^^^
PHLSAO^^^
PHXSAO^^^
PITSAO^^^
PWMSAO^^^
RNOSAO^^^
SATSAO^^^
SDFSAO^^^
SEASAO^^^
SFOSAO^^^
SJUSAO^^^
SLCSAO^^^
STLSAO^^^
TOPSAO^^^
WBCSAO^^^
WHXSAO^^^
WULSAO^^^
YFBSAO^^^
YQXSAO^^^
YYZSAO^^^

**ANY OF THE CCCNNNXXX'S ABOVE MAY BE ELIMINATED**
**OTHERS MAY BE INSERTED AS NEEDED**
**SAVE ORIGINAL VERSION OF MASTER CCCLIST.00**
^denotes a blank
```

Figure 6A. The master CCCLIST.nn distributed with the SAO decoder software package. Note that all nodes for the SAO's were included in this list, rather than just one entry of ^^^SAO^^^ to make it easier to edit the CCCLIST.nn file. In addition, the master file is an inefficient file since it includes CCCLIST entry types 1 and 2 along with type 3. This greatly increases the amount of time required to decode a set of observations.

```
E013
C013
S013
W013
SJU4
999
```

Figure 6B. The master SAOCLTVID.DT file distributed with the SAO Decoder software. This file should only be changed if additional SAO collectives are added to the AFOS system. Any SAO's sent in collectives with three or four letter ID's, and sent in the format stated in FMH #1, can be decoded by adding the XXX of the AFOS key CCCNNNXXX (cols. 1-3) and the number of letters in the ID (col. 4) to this file.

```
                [1-2]   [3]   [4]   [5]   [6]  [7]  [8]
STATION DATA:  STNID RTNCDE TIME OBTYPE  LAT  LON DSVS
                 DDC       1 1156      5  -99  -99  -99
                                [9] [10] [11-12] [13][14] [15-16] [17][18] [19-20] [21] [22] [23--24--25--26--27]
CLOUD/VISIBILITY/PRESENT WX:  [NH TVFH HNH CH] [NM TVFM HNM CM] [NL TVFL HNL CL] VSBY VVID WX1 WX2 WX3 WX4 WX5
                               B     0 110  M        0 -99          0 -99        10                          R-
                          [28]  [29] [30]  [31] [32] [33][34] [35]  [36]  [37]
PRESS/TEMP/WIND DATA:      SLP  TMPF  TDF  MXRT  DD   FF  GG  ALTM  TMPC  TDC
                         10192    62   60   114  70    7 -99  3018    17   16
                    [38-40] [41] [42]   [43]   [44]   [45]   [46]   [47] [48]
ADDITIVE DATA:     ASCVSBY PRTND PRCHG 3/6PCPN ICLTYP ICMTYP ICHTYP MXMNT SNOW
                      10+      1     8      11                        62    0
                                [49] [50] [51] [52] [53] [54]  [55]   [56]  [57]  [58]  [59]
MARINE DATA/ADDITIVE SAO DATA: TWTWC WVPD WVHT SWDR SWPD SWHT MINSUN 6HRMN 6HRMX 24HRMN 24HRMX
                               -99  -99  -99  -99  -99  -99   -99     62    90   -99   -99
                          [60]   [61]  [62]    [63]  [64]       [65]       [66]    [67]  [68]    [69]   [70]
RAINFALL/PEAK WIND DATA: 24HRRN 1HRRN RNCNTR PKWDIR PKWSPD  ASOSSTNTYP  AUTOCLD  CRMON  CRDAY  CRHOUR  CRMIN
                            11    -2    -99    -99    -99         241        8      6     14      11     56
```

ABBREVIATION	DEFINITION	WORD NO(S).
STNID	Station Call Letters	1-2
RTNCDE	Return Code	3
TIME	UTC Time	4
OBTYPE	Observation Type	5
LAT	Latitude	6
LON	Longitude	7
ELEV	Elevation	8
DSVS	Coded ships direction and speed	8
	ASCII "Q" if squalls are occurring in SAO	8
NH	Amount of highest cloud layer	9
TVFH	Thin/Variable flag for highest cloud layer	10
HNH	Height of highest cloud layer	11
CH	Ceiling indicator for highest cloud layer	12
SWDR	Swell direction (ASCII form)	12
NM	Amount of next lower cloud layer	13
TVFM	Thin/Variable flag for next lower cloud layer	14
WVPD	Wave period (ASCII form)	14
HNM	Height of next lower cloud layer	15
CM	Ceiling indicator for next lower layer	16
SWPD	Swell period (ASCII form)	16
NL	Amount of next lower cloud layer	17
TVFL	Thin/Variable flag for next lower cloud layer	18
WVHT	Wave height (ASCII form)	18
HNL	Height of next lower cloud layer	19
CL	Ceiling indicator for next lower cloud layer	20
SWHT	Swell height (ASCII form)	20
VSBY	Visibility (integer form)	21
VVID	Variable visibility indicator	22
WX1-WX5	Obstructions to Vision	23-27
SLP	Sea Level Pressure	28
TMPF	Temperature (°F)	29
TDF	Dewpoint (°F)	30
MXRT	Mixing ratio	31
DD	Wind direction	32
FF	Wind speed	33
GG	Wind gust or squall	34
ALTIN	Altimeter setting	35
TMPC	Temperature (°C)	36

(Figure 7 continued)

ABBREVIATION	DEFINITION	WORD NO(S).
TDC	Dewpoint (°C)	37
ASCVSB	Visibility (ASCII form)	38-40
PRTND	Pressure tendency characteristic	41
PRCHG	Pressure change	42
3/6PCPN	6-hour liquid precipitation	43
ICLTYP	Low cloud type	44
ICMTYP	Middle cloud type	45
ICHTYP	High cloud type	46
MXMNT	Maximum or minimum temperature	47
SNOW	12Z snow depth	48
TWTWF	Sea surface temperature (°F)	48
TWTWC	Sea surface temperature (°C)	49
WVPD	Wave period (integer form)	50
WVHT	Wave height (integer form)	51
SWDR	Swell direction	52
SWPD	Swell period (integer form)	53
SWHT	Swell height (integer form)	54
MINSUN	Minutes of sunshine	55
6HRMN	ASOS 6-hour minimum temperature (°F)	56
6HRMX	ASOS 6-hour maximum temperature (°F)	57
24HRMN	ASOS calendar day minimum temperature (°F)	58
24HRMX	ASOS calendar day maximum temperature (°F)	59
24HRRN	24-hour rainfall (inches)	60
1HRRN	ASOS hourly rainfall value (inches)	61
RNCNTR	AMOS/RAMOS rain counter value	62
PKWDIR	Wind direction given in PKWND remark	63
PKWSPD	Wind speed given in PKWND remark	64
ASOSSTNTYP	Extended station type (see Table 8)	65
AUTOCLD	Supplemental ceiling designator (see Table 5)	66
CRMON	AFOS creation month	67
CRDAY	AFOS creation day	68
CRHOUR	AFOS creation hour	69
CRMIN	AFOS creation minutes	70

Figure 7. Sample printout of one formatted observation produced by using the global "G" switch on the SAODECII command line. Listed above are definitions of the abbreviations, and their location in the SAODATA/SAODATASUP files. See Table 2 for more information.

APPENDIX I

Creating and Modifying Station Decoding Lists (CCCLIST's)

Before execution of SAODECII, you must establish a list(s) of observations that are to be decoded. This list is known as a CCCLIST. Lists are distinguished from one another by a two-letter RDOS extension. Each individual entry within the CCCLIST is referred to by the letters CCCNNNXXX. Entries are added to or deleted from the existing CCCLIST's using an RDOS text editor at the DASHER, such as QED.SV or EDIT.SV, or edited at an ADM using the command "e:f/". New CCCLIST's may also be created using the same RDOS text editors or the command "m:f/" at an ADM. "CCC" refers to the WSFO node. For some products, the product is a national product and the CCC is the same as your local node. CCCLIST's edited using QED.SV at the DASHER must be saved as random files before they can be displayed on an ADM. However, SAODECII does not require the CCCLIST's to be random files.

With the exception of Mexican SAO's, a collective of SAO's transmitted within one AFOS product or key requires special recognition in the SAOCLTVID.DT file. For each product containing a collective of SAO's rather than just one observation per product, include the XXX as columns 1-3 in the RDOS file SAOCLTVID.DT. In column 4, note the number of letters in the station ID for these observations. The last line of this file must be a "999".

There are seven different product categories (NNN's) which are recognized by SAODECII and can hence be used within a CCCLIST. The acceptable product categories (NNN's) are (i) "SAO", for United States, Canadian, Mexican, and Caribbean surface observations, (ii) "SHP" for regular 6-hour synoptic ship reports, (iii) "SHI" for intermediate synoptic hour (3-hour) ship reports, (iv) "SHN" for non-synoptic hour ship reports, (v) "BOY" for all coastal marine (C-MAN), moored, and drifting buoy data, (vi) "LAW" for Great Lakes ship reports, and (vii) "CGR" for Coast Guard ship reports. It should be noted that buoys are occasionally transmitted under the ship key identifiers. Finally, the "XXX" refers to the local product identifier, such as IAD in the surface observation "WBCSAOIAD". The local product identifiers may be examined using the command "p:CCCNNN" at an ADM. You may also determine from the "p:" command or from the command "key:CCCNNNXXX" if the product is identified as a national product (NWS 1989a).

Individual entries within a CCCLIST may take on <u>one</u> or <u>more</u> of three formats as follows: (i) Enter the entire "CCCNNNXXX", such as "WBCSAOIAD" to decode the observation for Washington-Dulles Airport, or enter NMCSAOC01 to decode all of the AWOS SAO's in this collective. (ii) Enter only the WSFO node and the product category (NNN), such as "WBCSAO" to decode all SAO's collected under the WSFO node "WBC". (iii) Enter just the product category "NNN", such as "^^^SAO^^^" (^ denotes a blank), which will result in the decoding of all SAO's resident in the local AFOS data base. (Note that with any of these types of entries, the location of the CCC, NNN, and XXX must be preserved. The CCC must always be located in columns 1-3, the NNN in columns 4-6, and the XXX in columns 7-9.

It should also be noted here, that mixing entries of type (i) and/or type (ii) above with entries of type (iii) will result in a reduction in efficiency for the SAO Decoder.

The last line of a CCCLIST must always contain "999999999".

Here are some sample CCCLIST's.

(I). Example of type (i) entry:

```
FTWSAODAL                                   line 1
FTWSAODFW                                   line 2
FTWSAOFTW                                   line 3
FTWSAOGVT                                   line 4
999999999                                   line 5
```

Decodes observations only for DAL, DFW, FTW, and GVT under node FTW.

(II). Example of type (ii) entry:

```
LITSAO^^^                                   line 1
OKCSAO^^^                                   line 2
999999999                                   line 3
```

Decodes all observations resident in the local AFOS database under the WSFO nodes LIT and OKC.

(III). Example of type (iii) entry:

```
^^^SAO^^^                                   line 1
^^^BOY^^^                                   line 2
999999999                                   line 3
```

Decodes all SAO's and BOY's resident in the local AFOS database.

(IV). Example of a mixture of all three types:

```
WBCSAOIAD                                   line 1
RDUSAO^^^                                   line 2
^^^BOY^^^                                   line 3
999999999                                   line 4
```

Decodes the observation Washington-Dulles, all SAO observations in the local AFOS database under the WSFO node RDU, and all buoys resident in the local AFOS database.

You should first make a copy of the master CCCLIST.00 and retain the original copy of the master CCCLIST.00 on this floppy. Then, you may create other CCCLIST.nn's from your copied version and edit them. Entries may be added or deleted anywhere within the list as necessary.

You are encouraged to edit your copy of the CCCLIST.00 and create others, since running the SAO Decoder with the master CCCLIST.00 will be too time consuming for standard forecast operations. Limit your CCCLIST.nn file entries to the minimum required for your particular application. You should create additional CCCLIST's for local application purposes.

APPENDIX II

Changing the Station Directory File

The station directory file (STDIR.MS) contains a listing of more than 2200 domestic surface, upper air, and radar observation stations. The file must be periodically updated as new stations are added and old stations are deleted. The information stored in this file for each station is the station ID, synoptic number, elevation, latitude, longitude, X and Y map background coordinates, and the zoom threshold. Program PLTGEN reads the STDIR.MS file to extract the X and Y map background coordinates and the zoom threshold value. This information, along with the data to be plotted, is written to a plot file on disk which is converted by one of the graphics generations programs into a displayable product.

Several utility programs are available to display or modify the STDIR.MS file. Three of these will be discussed here, namely, SDEDIT, ZOOMEDIT (Scott 1983), and WRDIR. It is assumed that you have already installed these programs and established appropriate links.

Program SDEDIT will allow you to add, delete, or change the individual entries in the STDIR.MS file. **Make sure you have a backup copy of the STDIR.MS file before you use this program.** To start this program, you type "SDEDIT" at the DASHER. Soon you will be asked whether you want to (A) add a station, (D) delete a station, (L) list a station, or (E) exit the program. To change the values of a station already in the STDIR.MS file, you must first delete that station, and then retype it with the new or correct values. When adding stations, make sure you follow exactly the instructions given on the DASHER. Always enter leading zeros, "+" signs, and "-" signs where required. Latitudes and longitudes are entered in decimal degrees. Suppose you have a station XXX with a block number of 20046, an elevation of 46 meters, a latitude of 5.69 degrees, and a longitude of 133.43 degrees east. This would be entered as

```
SSSSS EEEE +AAAA +LLLLL
20046 0046 +0529 +13343
```

Program ZOOMEDIT can be used to change the zoom threshold levels for selected stations. ZOOMEDIT is an interactive background program which also can only be run at the DASHER.

1. At the DASHER enter:

   ZOOMEDIT

2. Respond to ENTER ID: with the call sign (6 characters or less) of the station for which you wish to change the zoom level.

3. Respond to ZOOM (1, 2, 3) with one of the valid zoom threshold values, which are:

   0 = Data appears at all zoom levels
   1 = Data first appears at 4:1 zoom
   2 = Data first appears at 9:1 zoom
   3 = Data first appears at 16:1 zoom
   4 = Data not plotted.

4. The program will continue to re-cycle through the prompts until a space is entered for the ID to terminate it.

Program WRDIR will display the contents of the STDIR.MS file on either the printer plotter module (PPM) or the background console (DASHER). To run this program, at the ADM, enter:

```
RUN:WRDIR.
```

APPENDIX III

Creating Synoptic Graphics Displays

There are two standard software packages used by the field to generate graphics in an AFOS environment, REGPLOT (Chia 1984) and PMOD (Davis 1983). Shown below are examples of creating graphics displays from plot files generated by PLTGEN. It is strongly recommended that you consult the publications referenced above for more information on PMOD and REGPLOT and other material pertaining to AFOS graphics.

To create a displayable graphic with REGPLOT, the following entry can be made at the ADM:

```
RUN:REGPLOT NMCPLTSAO NMCGPHxxx ccc/C nnnn/R
```

where:

NMCPLTSAO = The input AFOS UGG plot file created by PLTGEN or another UGG program.
NMCGPHxxx = The output graphic which can be displayed on the GDM, where xxx denotes the three letters by which the graphic may be displayed (e.g., P23 for graphic NMCGPHP23).
ccc = A WSFO which will be the center of a circle with radius nnnn within which the data will be plotted.
nnnn = The radius of a circle centered on ccc. All stations within the circle are plotted. Only stations with zoom level Ø are plotted outside the circle.

To create a displayable graphic with PMOD, the following entries are made at the ADM:

```
RUN:PMOD/B SAO SFCVS.PM/O NA.PF/T  (if SAODECII is run without global
RUN:GENUTF XPLOT xxx                "F" switch.)
```

or:

```
RUN:PMOD/B GP/F SFCVS.PM/O NA.PF/T (if SAODECII is run with global
RUN:GENUTF XPLOT xxx                "F" switch.)
```

where:

SAO = stands for the xxx of the AFOS plot file "NMCPLTSAO" produced by PLTGEN or another UGG program.
GP = refers to the RDOS file "GP", also produced by PLTGEN, which may be used in lieu of the AFOS product NMCPLTSAO. The RDOS file GP is only available when SAODECII is run with the global "F" switch.
xxx = The xxx of the AFOS product, NMCGPHxxx, where the final graphics product will be stored (e.g, P20 would result in the graphic being stored under NMCGPHP20).
SFCVS.PM = The plot model offset file which determines the location and type of data plotted around the station circle.
NA.PF = The North American map background parameter file for plotting station data on a North American map background (i.e., AFOS graphic NMCGPHB02).

Note: The file SFCVS.PM is one of several surface plot model offset

files available in the PMOD package. You should determine which is best for your operation. In addition, other map background parameter files other than NA.PF are available. For further information on the use of REGPLOT or PMOD, please consult the appropriate National Weather Service publications.

At most stations, RDOS macros have been established so that the graphic programs do not have to be run directly at the ADM or Dasher. These files usually contain the appropriate RDOS commands to execute the programs for the station's area of interest. See the last section of this Appendix for a sample macro.

Figs. III-1 and III-2 are examples of graphics displays created from decoded data by the PMOD graphics generation package. The data are distributed around the station circle in the standard plot format which is illustrated in Fig. III-3.

Creating Weather Depiction Graphics Displays

To create a weather depiction graphic display you must first run the program SAODECII with the global "W" switch activated such as:

```
RUN:SAODECII/I/S/W bb/B nn/C
```

When this is done, an RDOS file WXDATA.bb is created where "bb" corresponds to the map background used in the SAODECII command line, or the default map background of B02.

You may then run program WXPLOT (Sunkel 1982) to generate the weather depiction chart. WXPLOT requires an AFOS graphics storage product with the name NMCGPHP(bb+5Ø), where bb is the map background indicator number. As an example, if the United States map background (B03) was used, the graphic product name would be NMCGPHP53. To create a weather depiction chart the following entry can be made at the ADM:

```
RUN:WXPLOT
```

See Fig. III-4 shows an example of a weather depiction graphics display created in this manner. Fig. III-5 shows the data as they are distributed around the station circle on the weather depiction chart.

Creating a Full Set of Graphics Displays

It is often desirable to create synoptic and weather depiction charts from the same decoded data. The following example illustrates a procedure that may be installed on your system to decode observations, plot them on a North American map background, and create a weather depiction chart on a North American map background.

```
RUN:SAODECII/I/S/Z/W/F 02/B 03/C (denotes N.A. map background).
RUN:PMOD/B GP/F SFCVS.PM/O NA.PF/T
RUN:GENUTF XPLOT P02  (will expect to find NMCGPHP02).
RUN:WXPLOT  (will expect to find NMCGPHP52).
```

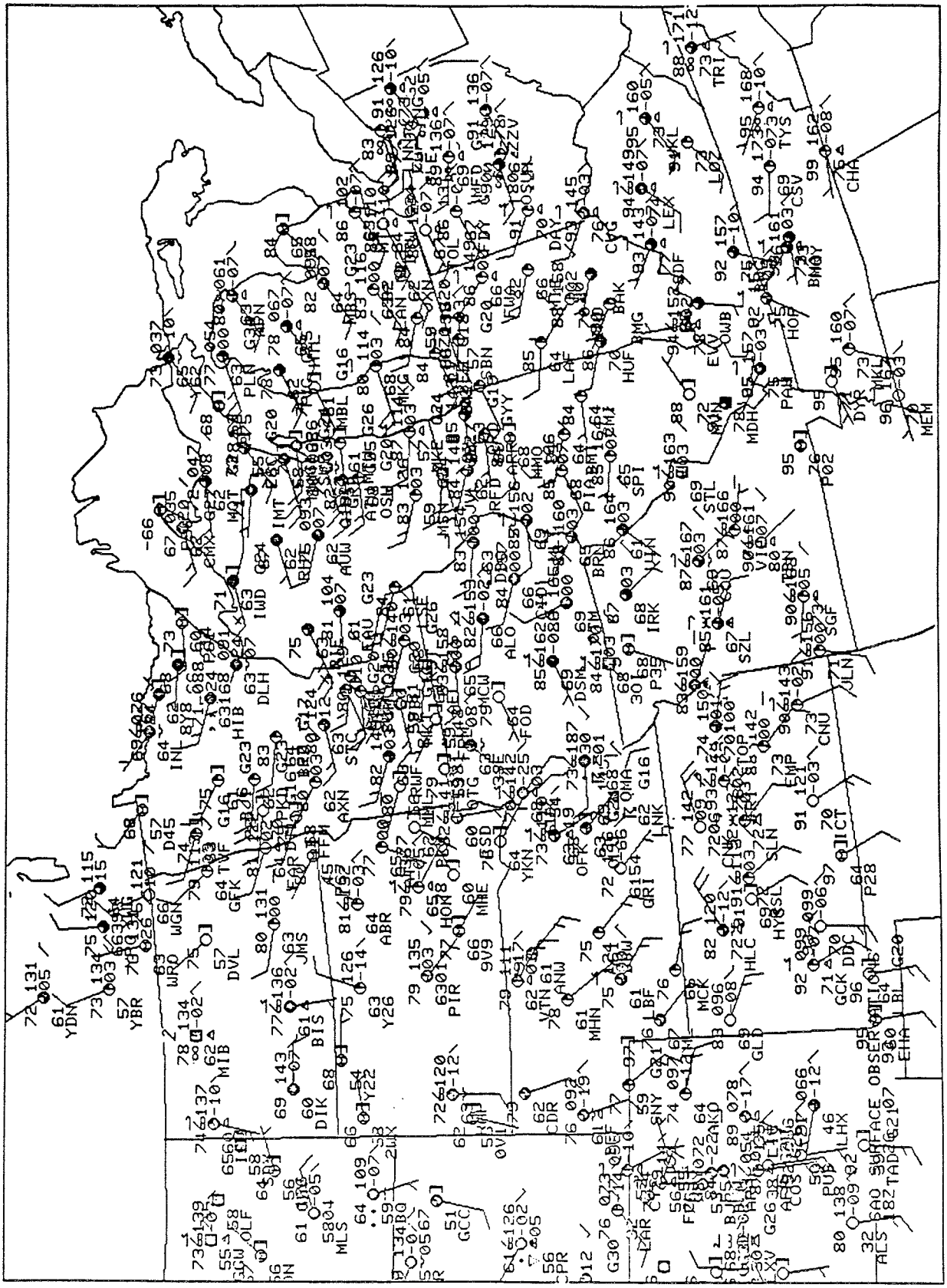


Figure III-1. SAO data plotted on the PMOD Central Region map background and displayed at a 1:1 zoom ratio.

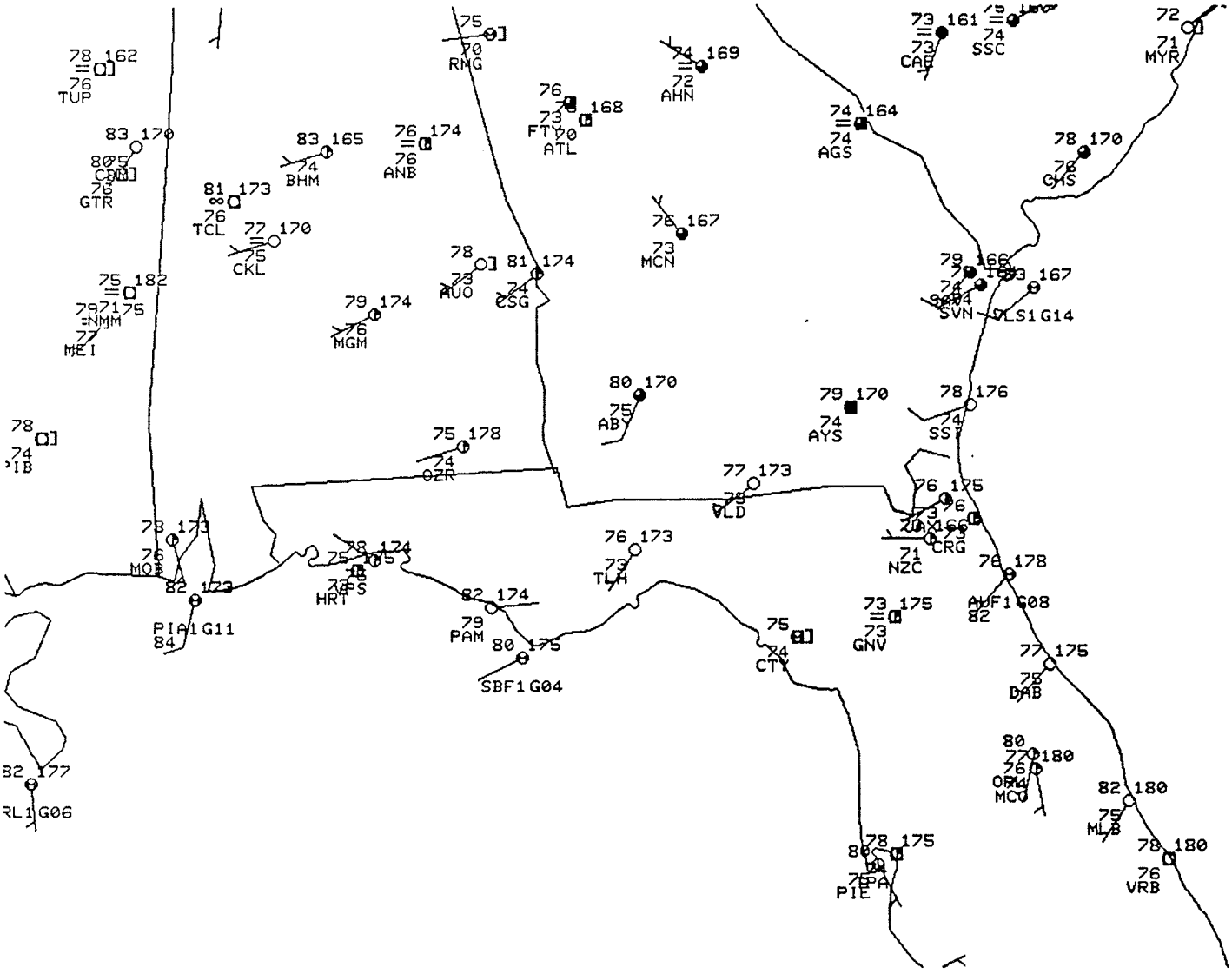
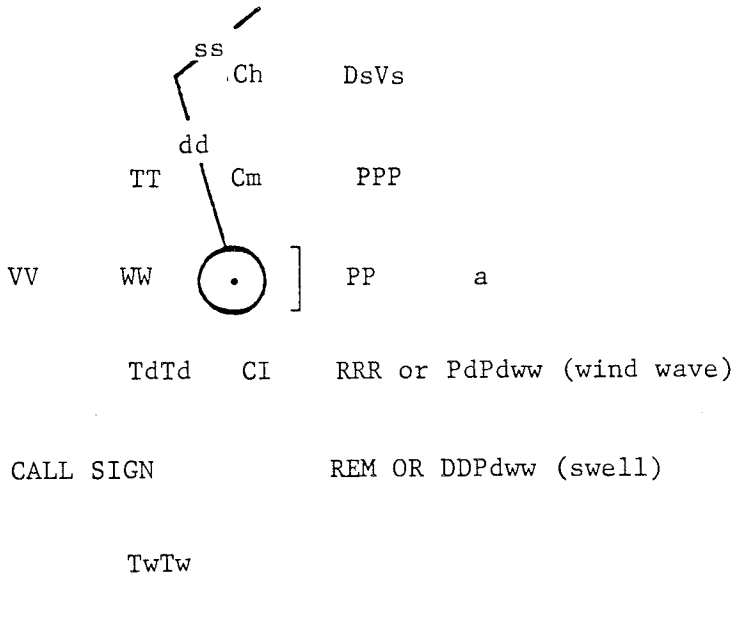


Figure III-2. Data from land and ship stations plotted on a North American map background with the PMOD software at a 25:1 zoom ratio.



ss	=	Wind speed
Ch	=	High cloud type
DsVs	=	Ship direction and speed of movement
dd	=	wind direction
TT	=	Temperature
Cm	=	Middle cloud type
PPP	=	Sea-level pressure
VV	=	Visibility
WW	=	Present weather
]	=	Automatic station identifier (ASOS, AWOS, etc...)
pp	=	3-hour pressure change
a	=	Pressure tendency
TdTd	=	Dewpoint temperature
Cl	=	Low cloud type
RRR	=	3/6 hour rainfall amount
PdPd	=	Wave period
ww	=	Wave height
REM	=	Remarks
DD	=	Swell direction
Pdww	=	Swell period and height
TwTw	=	Sea surface temperature

Figure III-3. The arrangement of data around the station circle as plotted by PMOD and REGPLOT. The data are designated by letter symbols also defined.

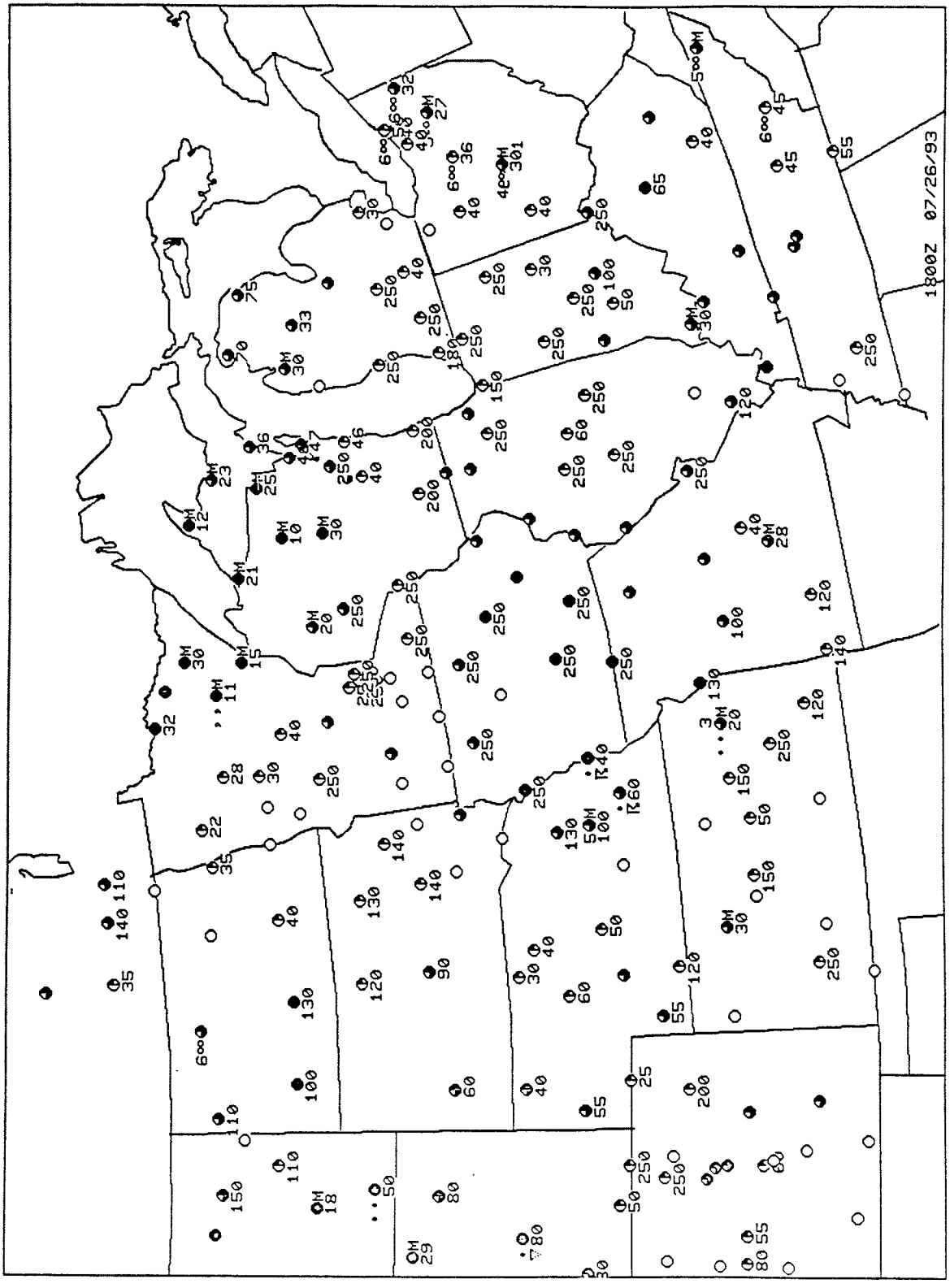
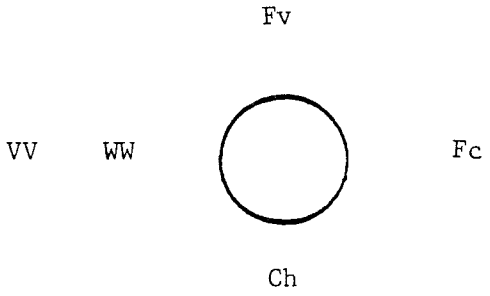


Figure III-4. An example of the weather depiction chart produced by program WXPLOT. Each station plot contains the ceiling height below the station circle, the weather to the left, visibility to the left or above, and cloud cover in the circle. To the right of the circle an "M" for marginal conditions, an "I" for LFR, or a blank for VFR conditions is plotted.



Fv	-	Fractional visibility below 3 miles
VV	-	Whole visibility in miles
WW	-	Present weather
Fc	-	Flying conditions
		I = IFR
		M = Marginal VFR
Ch	-	Ceiling height

Figure III-5. The arrangement of data around the station circle as plotted by WXPLOT. The data are designated by letter symbols defined in the table.

APPENDIX IV

Symbolic Code Formats and Definitions for Surface Observations

This Appendix provides the generic symbolic formats for all of the different types of observations which can be decoded by SAODECII. Following the presentation of the symbolic formats are definitions of all of the symbolic codes used. The formats are intended to be as complete as possible. However, few, if any, of the actual transmitted observations will contain all of the elements listed in these symbolic formats.

Section IV-1 provides the definitions for U.S./Canadian/Mexican SAO's (FAA 1984, FAA 1991, NWS 1979, NWS 1981, NWS 1992c, NWS 1992c, OFCM 1984, and OFCM 1988a), Section IV-2 provides those for all types of buoys (National Data Buoy Center 1990, OFCM 1988b, and WMO 1988), Section IV-3 provides those for ships (OFCM 1988b and WMO 1988), and Section IV-4 lists those for Coast Guard reports (no reference available).

Each report consists of a mandatory section (the body) and generally includes a secondary section (Remarks and Additive Data). The "Remarks" section generally applies only to manual or augmented SAOs. Delimiters are used to separate each element in the symbolic report. A delimiter will be either a space, a solidus "/" or a less than character "<". Note: Manual Canadian observations replace the "/" delimiter with a "<" for any group marked as questionable by the AUTO# quality control process.

The generic symbolic codes are listed below.

U.S./CANADIAN/MEXICAN SAOs (Section IV-1)

This section provides the symbolic formats for manual and automated U.S., Canadian, and Mexican SAO's.

MANUAL U.S. AND CARIBBEAN OBSERVATIONS

Typical record manual SAO

iii(i) FM GGgg SKY VVww ppp/(T)TT/(T_d)T_dT_d/ddff(G)(Q)(f_mf_m)/QNH/ RVR RVV TWR VSBY or SFC VSBY # WSHFT hhmm FROPA OTRRMKS/ appRR 99ppp 1tlpcp $1C_1C_mC_h$ $902S_pS_p$ $903S_pS_p$ $904S_pS_p$ T_nT_n or T_xT_x $2R_{24}R_{24}R_{24}R_{24}$ $4T_xT_xT_nT_n$ RADAT RAICG UA UUA 98xxx NOTAMS $T_cT_cT_c$

ASOS (A02, A02A)

iii(i) FM GGgg $M_jM_jM_j(M_j)$ SKY VVww ppp/(T)TT/(T_d)T_dT_d/ddff(f)(G)(Q)$f_mf_mf_m$/QNH/ RVR/ OSR/ SPN/ 98xxx/ 5appp 6RRR/ 1tlpcp $7R_{24}R_{24}R_{24}R_{24}$ $1s_nT_xT_xT_x$ $2s_nT_nT_nT_n$ $4s_nT_xT_xT_xs_nT_nT_nT_n$/ $CIGC_nC_nVC_xC_x$ TWR VSBY or SFC VSBY # VSBY $V_nV_nVV_xV_x$ PBPE PCPN rrrr WSHFT hmm FROPA WND $d_1d_1Vd_2d_2$ PK WND ddff(f)/hhmm PRESRR PRESFR PRJMP $p_cp_c/h_bh_bm_bm_b/h/_eh_em_em_e$ PWINO ZRNO TNO $

(NOTE: for the remaining formats listed here, **bold letters** denote the Remarks and Additive Data sections of the observation.)

SAWR

iii FM GGgg $M_iM_iM_jM_j$ SKY VVww /TT/T_dT_d/ddffGf_mf_m/QNH/ OSR

AUTOMATED U.S. AND CARIBBEAN OBSERVATIONS

Staffed AMOS

iii FM GGgg $M_iM_iM_jM_j$ SKY VVww ppp/TT/T_dT_d/ddff/QNH PK WND f_Pf_P RRRy/ MISCRMKS

Unstaffed AMOS

iii FM GGgg $M_iM_iM_jM_j$ TT/T_dT_d/ddff/QNH PK WND f_Pf_P RRR

RAMOS

iii FM GGgg $M_iM_iM_jM_j$ /TT/T_dT_d/ddff/QNH PK WIND f_Pf_P appRRR RNO or RM T_xT_x or T_nT_n $2R_{24}R_{24}R_{24}R_{24}$

AUTOB

iii FM GGgg $M_iM_iM_jM_j$ SKY BV_BV_B P TT/T_dT_d/ddff/QNH PK WIND f_Pf_P RRR

AWOS

iii FM GGgg $M_iM_iM_jM_j$ SKY VV TT/T_dT_d/ddffGf_mf_m/QNH/ PRRR/AUTORMKS

AWOS (manually augmented)

iii FM GGgg $M_iM_iM_jM_j$ SKY VV TT/T_dT_d/ddffGf_mf_m/QNH/ PRRR/AUTORMKS/WEA: WEARMKS

A01 (AWOS, unaugmented)

iii FM GGgg $M_iM_iM_jM_j$ SKY VV ppp/TT/T_dT_d/ddffGf_mf_m/QNH/ OSR/ 98xxx/ 5appp 6RRR/ $7R_{24}R_{24}R_{24}R_{24}$ $1s_nT_xT_xT_x$ $2s_nT_nT_nT_n$ $4s_nT_xT_xT_xs_nT_nT_nT_n$/ $CIGC_nC_nVC_xC_x$ TWR VSBY # VSBY $V_nV_nVV_xV_x$ PBPE PCPN rrrr WSHFT hhmm FROPA WND $d_1d_1Vd_2d_2$ PK WND ddff/hhmm PRESRR PRESFR PRJMP $p_cp_c/h_bh_bm_bm_b/h_eh_em_em_e$ PWINO ZRNO TNO $

A01A (AWOS, manually augmented)

iii FM GGgg $M_iM_iM_jM_j$ SKY VVww ppp/TT/T_dT_d/ddffGf_mf_m/QNH/ RVR/ SPN/ OSR/ 98xxx/ 5appp 6RRR/ $7R_{24}R_{24}R_{24}R_{24}$ $1s_nT_xT_xT_x$ $2s_nT_nT_nT_n$ $4s_nT_xT_xT_xs_nT_nT_nT_n$/ $CIGC_nC_nVC_xC_x$ TWR VSBY # VSBY $V_nV_nVV_xV_x$ PBPE PCPN rrrr WSHFT hhmm FROPA WND $d_1d_1Vd_2d_2$ PK WND ddff/hhmm PRESRR PRESFR PRJMP $p_cp_c/h_bh_bm_bm_b/h_eh_em_em_e$ PWINO ZRNO TNO $

MANUAL CANADIAN OBSERVATIONS

Typical record SAO

iii FM GGgg SKY VVww ppp/TT/T_dT_d/ddffGf_mf_m/QNH/ RMKS/Additive Data appp

AUTOMATED CANADIAN OBSERVATIONS

AUTO#

iii FM GGgg $M_iM_iM_jM_j$ SKY V.V_I PP_I ppp/TTT/$T_dT_dT_d$/ddffGf_mf_m/QNH/RRRR appp
or
iii FM GGgg $M_iM_iM_jM_j$ SKY V.V_I PP_I ppp/TTT/$T_dT_dT_d$/ddffGf_mf_m/QNH/ appp

MANUAL MEXICAN OBSERVATIONS

iii FM GGgg SKY VVww ppp TT/T_dT_d ddff/QNH/ RMKS/Additive Data

BUOY DATA ELEMENTS (Section IV-2)

This section provides the symbolic format for moored buoys, drifting buoys, and coastal marine (C-MAN) buoys. Note that an "equals sign" (=) is appended to the last group of a buoy observation to signify the end of that report.

Moored and C-MAN (not land fixed)

$M_iM_iM_jM_j$ $A_1b_wn_bn_bn_b$ YYGGi_w 99$L_aL_aL_a$ $Q_cL_oL_oL_oL_o$ i_Ri_xhVV Nddff 00fff $1s_nTTT$ $2s_nT_dT_dT_d$ 4PPPP 5appp 9GGgg 22200 $0s_nT_wT_wT_w$ $1P_{wa}P_{wa}H_{wa}H_{wa}$ $70H_{wa}H_{wa}H_{wa}$ 333 912ff 555 11fff 22fff 3GGgg 4dd$f_mf_mf_m$ 6$G_cG_cg_cg_c$ $d_1d_1d_1f_1f_1f_1$ $d_2d_2d_2f_2f_2f_2$ $d_3d_3d_3f_3f_3f_3$ $d_4d_4d_4f_4f_4f_4$ $d_5d_5d_5f_5f_5f_5$ $d_6d_6d_6f_6f_6f_6$

Drifting buoys

$M_iM_iM_jM_j$ $A_1b_wn_bn_bn_b$ YYMMJ GGggi_w $Q_cL_aL_aL_aL_aL_a$ $L_oL_oL_oL_oL_oL_o$ 0ddff $1s_nTTT$ 2PPPP 3appp 222 $0s_nT_wT_wT_w$ $1P_{wa}P_{wa}H_{wa}H_{wa}$ $20P_{wa}P_{wa}P_{wa}$ $21H_{wa}H_{wa}H_{wa}$ 333 ...(optional bathythermal data) 444 ... (other optional data/operational status) ...

C-MAN (land/fixed site)

$M_iM_iM_jM_j$ YYGGi_w iiiii i_Ri_xhVV Nddff (00fff) $1s_nTTT$ $2s_nT_dT_dT_d$ 4PPPP 5appp 6RRRt_R 9GGgg 222D_SV_S $0s_nT_wT_wT_w$ $1P_{wa}P_{wa}H_{wa}H_{wa}$ $70H_{wa}H_{wa}H_{wa}$ 333 912ff (912ff) 555 11fff 22fff 3GGgg 4dd$f_mf_mf_m$ 6$G_cG_cg_cg_c$ $d_1d_1d_1f_1f_1f_1$ $d_2d_2d_2f_2f_2f_2$ $d_3d_3d_3f_3f_3f_3$ $d_4d_4d_4f_4f_4f_4$ $d_5d_5d_5f_5f_5f_5$ $d_6d_6d_6f_6f_6f_6$ MWAVE or PWAVE TIDEnnnn

SHIP REPORTS (Section IV-3)

This section provides the symbolic format for ship reports. Note that an "equals sign" (=) is appended to the last group of a ship observation to signify the end of that report.

Standard ship reports

[SPREP or STORM] D....D YYGGi_w 99$L_aL_aL_a$ $Q_cL_oL_oL_oL_o$ i_ri_xhVV Nddff (00fff) $1s_nTTT$ $2s_nT_dT_dT_d$ 4PPPP 5appp 7wwW_1W_2 $8N_hC_LC_MC_H$ 222D_sV_s $0s_nT_wT_wT_w$ $2P_wP_wH_wH_w$ $3d_{w1}d_{w1}d_{w2}d_{w2}$ $4P_{w1}P_{w1}H_{w1}H_{w1}$ $5P_{w2}P_{w2}H_{w2}H_{w2}$ $6I_sE_sE_sR_s$ ICE $c_iS_ib_iD_iz_i$

Great Lakes ship reports

[SPREP or STORM] D....D YYGGi_w 99$L_aL_aL_a$ $Q_cL_oL_oL_oL_o$ i_Ri_xhVV Nddff (00fff) $1s_nTTT$ $7wwW_1W_2$ $222D_sV_s$ $0s_nT_wT_wT_w$ $2P_wP_wH_wH_w$ $6I_sE_sE_sR_s$ ICE $c_iS_ib_iD_iz_i$

COAST GUARD REPORTS (Section IV-4)

This section provides the symbolic format for Coast Guard reports. **Note that the top line is included as the first line in a collective of Coast Guard observations.**

ID	WXVSB	/WINDS/WAVE	/SEA	/AIR/PRES	REMARKS	STATION NAME
iii	wwVV	/dddff/$P_{wa}P_{wa}H_{wa}H_{wa}$/T_wT_w	/TT	/pppp	**RMKS**	**Station Name**

Section IV-1: U.S./Canadian/Mexican/Caribbean SAO's Symbolic Definitions

iii - Station identifier

FM - Type of observation

Valid Types

SA (record)
RS (record special)
SP (special)
USP (urgent special)
L (local)
COR SA (corrected record)
COR RS (corrected record special)
COR SP (corrected special)

$M_iM_iM_jM_j$ - Type of station

Valid Types	
	(manual SAO)
	(U.S. SAWR)
SAWR	(Canadian SAWR)
AMOS	(staffed/unstaffed)
RAMOS	(staffed/unstaffed)
AUTOB	
AUTO#	(Canadian)
AWOS	
A01	(AWOS, unaugmented)
A01A	(AWOS, augmented)
A02	(ASOS, unaugmented)
A02A	(ASOS, augmented)

GGgg - Time of observation

GG - hours
gg - minutes

SKY - Sky condition and ceiling

- cloud amount indicator
- cloud height in hundreds of feet
- ceiling indicator
- thin/variable flag

VVww - Visibility and weather (Reference: NWS, 1988a and NWS, 1991a)

VV - Prevailing visibility in miles
ww - Weather and obstructions to vision

ppp - Sea level pressure in tenths of a millibar

TT - Temperature in whole degrees °F for U.S./Caribbean reports and °C for all others

T_dT_d - Dew point in whole degrees °F for U.S./Caribbean and °C all others

ddff - Wind speed and direction

dd - direction in tens of degrees
ff - speed in knots. Can be a two or three number group (fff).

Gf_mf_m - Wind gust and peak wind

G - indicator for gusts and squalls

Valid Values
G = G: Gust indicator, U.S.
G = Q: Squall indicator, U.S.
G = +: Gust indicator, Canada

f_mf_m - peak speed in knots, whether gust or squall, during the past ten minutes. Can be a two or three number group ($f_mf_mf_m$).

QNH - Altimeter setting to the nearest hundredth of an inch of mercury

AUTOB

BV_BV_B - Backscatter visibility in past 10 minutes. Reported in whole miles.

P - Precipitation indicator (P = precipitation, (blank) = no precipitation)

AUTO# (Canadian)

$V.Vn_I$ - Visibility Index in tenths of a statute mile

PP_I - Precipitation intensity

MEXICAN

SKY - Sky condition and ceiling
- cloud amount indicator
- cloud height in hundreds of feet
- ceiling indicator
- thin/variable flag

TYPICAL MANUAL RECORD SAO

RVR - Runway Visual Range

RVV - Runway visibility

SFC - Surface-based obscuring phenomena

TWR (SFC) VSBY - Higher tower (surface) visibility (if necessary)

WSHFT - Wind shift

FROPA - Frontal passage

OTRRMKS - Remarks elaborating on previously decoded data (mainly plain language), significant to air traffic controllers and meteorologists

appRR - Pressure tendency/precipitation

a - pressure tendency characteristic
pp - pressure tendency
RR - liquid equivalent precipitation during the last three or six hours, to the nearest hundredth of an inch

99ppp - Group for pressure changes greater than 9.8 millibars (pp in appRR os reported as 99 in such cases)

99 - Group indicator
ppp - pressure change greater than 9.8 millibars

ltlpcp - Literal precipitation (ONE, TWO, THREE,...,NINE) is included when amount of precipitation is one inch or more

1$C_LC_MC_H$ - Cloud group (For CL, CM, CH, a / shall be encoded if above an overcast layer)

1 - group indicator
C_L - wx code for low cloud type
C_M - wx code for middle cloud type
C_H - wx code for high cloud type

$902s_ps_p$ - Water equivalent of depth of snow on the ground

902 - group indicator for water equivalent of snow depth
s_ps_p - water equivalent of snow depth in inches and tenths (e.g., 1.3)

$903s_ps_p$ - Group used with $902s_ps_p$ to report water equivalent of snow depth > 9.9 inches

903 - group indicator for water equivalent of snow depth > 9.9 inches
s_ps_p - water equivalent of snow depth to the nearest inch

$904s_ps_p$ - Group used to report depth of snow on the ground (For every 100 inches of snow on the ground, a 90499 group is encoded. Example: 103 inches of snow is encoded as 90499 90403)

T_nT_n or **T_XT_X** - Minimum or maximum temperature

T_nT_n - Minimum temperature
1200 UTC - for the past 12 hours
1800 UTC - for the past 24 hours

T_XT_X - Maximum temperature
0000 UTC - for the past 12 hours
0600 UTC - for the past 24 hours

$2R_{24}R_{24}R_{24}R_{24}$ - 24-hour precipitation reported at 1200 UTC

2 - Group indicator for the 24-hour precipitation
$R_{24}R_{24}R_{24}R_{24}$ - precipitation amount to the nearest hundredth of an inch

$4T_XT_XT_nT_n$ - Temperature extremes (reported at 1200 UTC only at selected stations)

4 - group indicator for temperature extremes
T_XT_X - maximum temperature for the previous day (midnight to midnight, LST) in whole degrees Fahrenheit
T_nT_n - minimum temperature for the previous 12 hours in whole degrees Fahrenheit

RADAT - Freezing level data from radiosonde.

RAICG - Icing data from radiosonde.

UA and **UUA** - Pilot reports (PIREPS)

UA - routine PIREP
UUA - urgent PIREP

98xxx - Duration of Sunshine

98 - group indicator
xxx - total sunshine in minutes

NOTAMS - Notice to Airmen

CITY $T_CT_CT_C$ - City temperature (reported only at selected stations)

CITY - indicates city temperature follows
$T_CT_CT_C$ - city temperature in whole degrees Fahrenheit

ASOS (A01, A01A, A02, A02A)

RVR - Runway Visual Range

SPN - Special Notices

OSR - Operationally Significant Remarks

OCR - Other Coded Remarks

$8/C_LC_MC_H$ - Synoptic Cloud Types

8/ - Group indicator
C_L - Predominant low cloud
C_M - Predominant middle cloud
C_H - Predominant high cloud

4/sss - Depth of Snow on Ground

4/ - Group indicator
sss - Snow depth in whole inches

98xxx - Duration of Sunshine

AD - Additive Data

5appp - 3-hour pressure tendency and change

5 - group indicator for 3-hour pressure tendency
a - pressure tendency code
ppp - net change in station pressure or altimeter setting in tenths of millibars

6RRR/ - Precipitation amount

6 - group indicator for precipitation amount
RRR - liquid equivalent precipitation during the last three or six hours, to the nearest hundredth of an inch
/ - "place holder" (to keep group 5 digits)

1tlpcp - literal precip (ONE, TWO, THREE,..., NINE) is included when amount of precip is one inch or more

$7R_{24}R_{24}R_{24}R_{24}$ - 24-hour precipitation amount

7 - group indicator for 24-hour precipitation amount
$R_{24}R_{24}R_{24}R_{24}$ - liquid equivalent precipitation during the last 24 hours, to the nearest hundredth of an inch

$1s_nT_XT_XT_X$ - Maximum Temperature

1 - indicator for maximum temperature group
s_n - sign of maximum temperature
encoded as 0 if $T_XT_XT_X \geq 0$
encoded as 1 if $T_XT_XT_X < 0$
$T_XT_XT_X$ - maximum temperature in °F

$2s_nT_nT_nT_n$ - Minimum Temperature

1 - indicator for minimum temperature group
s_n - sign of minimum temperature
encoded as 0 if $T_nT_nT_n \geq 0$
encoded as 1 if $T_nT_nT_n < 0$
$T_nT_nT_n$ - minimum temperature in °F

$4s_nT_xT_xT_xs_nT_nT_nT_n$ - 24-hour Maximum and Minimum Temperature

- 4 - indicator for 24-hour maximum and minimum temperature group
- s_n - sign of each temperature
- $T_xT_xT_x$ - maximum temperature in °F
- $T_nT_nT_n$ - minimum temperature in °F

RECD - Remarks Elaborating on Other Coded Elements

CIG $C_nC_nVC_xC_x$ - Variable ceiling

- CIG - Variable ceiling indicator
- C_nC_n - Minimum ceiling
- V - Separates minimum ceiling from maximum ceiling
- C_xC_x - Maximum ceiling

TWR (SFC) VSBY # - Tower (surface) visibility in miles. Added when tower and surface visibilities differ or are both less than 4 miles

VSBY $V_nV_nVV_xV_x$ - Variable visibility reported when sfc. visibility is less than 3 miles and variable.

- VSBY - Variable visibility indicator
- V_nV_n - Minimum visibility
- V - Separates minimum visibility from maximum visibility
- V_xV_x - Maximum visibility

PBPE - Beginning and End time of precipitation

PCPN rrrr - Hourly precipitation accumulation report

- PCPN - Precipitation accumulation report indicator
- rrrr - Precipitation accumulation in hundredths of an inch

WSHFT hhmm FROPA - Wind shift and frontal passage data

- WSHFT - Wind shift indicator
- hhmm - time (UTC) that the wind shift occurred.
- FROPA - FROPA added if wind shift is associated with a frontal passage.

WND $d_1d_1Vd_2d_2$ - Variable wind speed and direction

- WND - Variable wind indicator
- d_1d_1 - Wind direction (the one extreme)
- V - Separates the two wind directions
- d_2d_2 - Wind direction (the other extreme)

PK WND ddff/hhmm - Peak wind speed in knots (reported speed is highest detected since last hourly observation)

- PK WND - Peak wind identifier
- ddff - peak wind direction and speed
- hhmm - time (UTC) of peak wind speed occurrence.

PRESRR PRESFR - Report of pressure rising or falling rapidly

PRJMP $p_cp_c/h_bh_bm_bm_b/h_eh_em_em_e$ - Pressure jump

- PRJMP - indicates pressure jump data follows
- p_cp_c - pressure jump in hundredths of inches of mercury
- $h_bh_bm_bm_b$ - time pressure jump began (UTC)
- $h_eh_em_em_e$ - time pressure jump ended (UTC)

PWINO - Precipitation identifier not operational

ZRNO - Freezing rain sensor not operational

TNO - Thunderstorm information not available

$ - Maintenance check indicator

AMOS (STAFFED AND UNSTAFFED), RAMOS, AND AUTOB

PK WND f_pf_p - Peak wind speed in knots (reported speed is highest detected since last hourly observation)

- PK WND - Peak wind identifier
- f_pf_p - peak wind speed

app - Pressure tendency and change (RAMOS only)

- a - pressure tendency code
- pp - pressure change

RRR - Precipitation accumulation since last synoptic time in hundredths of inches (Example: 123 = 1.23"; 001 = 0.01")

STAFFED AMOS

MISCRMKS - Miscellaneous remarks

STAFFED AND UNSTAFFED AWOS

PRRR - Precipitation accumulation

- P - precipitation accumulation report indicator
- RRR - precipitation accumulation in hundredths of an inch (Example: P123 = 1.23")

VSBY $V_nV_nVV_xV_x$ - Variable visibility

- VSBY - Variable visibility indicator
- V_nV_n - Minimum visibility
- V - Separates minimum visibility from maximum visibility
- V_xV_x - Maximum visibility

WND $d_1d_1Vd_2d_2$ - Variable wind speed and direction

- WND - Variable wind indicator
- d_1d_1 - Wind direction (the one extreme)
- V - Separates the two wind directions
- d_2d_2 - Wind direction (the other extreme)

STAFFED AWOS

WEA: - Manual Weather Augmentation (see reference NWS, 1991)

WEARMKS - Miscellaneous augmented remarks

RAMOS

RNO - No precipitation during the 10 minutes prior to the observation time.
RM - Precipitation data for the 10 minutes prior to observation time missing.

T_nT_n or T_xT_x - Minimum or maximum temperature

T_nT_n - Minimum temperature
1200 UTC - for the past 12 hours
1800 UTC - for the past 24 hours
T_xT_x - Maximum temperature
0000 UTC - for the past 12 hours
0600 UTC - for the past 24 hours

$2R_{24}R_{24}R_{24}R_{24}$ - 24-hour precipitation reported at 1200 UTC

2 - group indicator for the 24-hour precipitation
$R_{24}R_{24}R_{24}R_{24}$ - precipitation amount to the nearest hundredth of an inch

VSBY $V_nV_nVV_xV_x$ - Variable visibility

VSBY - Variable visibility indicator
V_nV_n - Minimum visibility
V - Separates minimum visibility from maximum visibility
V_xV_x - Maximum visibility

WND $d_1d_1Vd_2d_2$ - Variable wind speed and direction

WND - Variable wind indicator
d_1d_1 - Wind direction (the one extreme)
V - Separates the two wind directions
d_2d_2 - Wind direction (the other extreme)

MANUAL CANADIAN AND MEXICAN OBSERVATIONS

RMKS/Additive Data

MANUAL CANADIAN

appp - 3-hour pressure tendency

a - 3-hour pressure tendency code
ppp - net station pressure change in tenths of millibars

AUTO# STATIONS (Canadian)

RRRR - Accumulated rainfall since the previous main synoptic hour in tenths of a millimeter

appp - 3-hour pressure tendency

a - 3-hour pressure tendency code
ppp - net station pressure change in tenths of millibars

Section IV-2: Buoy Symbolic Format Definitions

Moored Buoy & C-MAN (Buoy)

(Section 0 - Identification)

$M_iM_iM_jM_j$ - Bulletin header encoded as BBXX. Identifies the bulletin as a group of reports from ocean stations (This is not transmitted from the buoy, but it is added into a group of reports before they are transmitted in a bulletin)

$A_1b_wn_bn_bn_b$ - Buoy identifier (5 digits)

- A_1 - WMO Region in which the buoy is located
- b_w - Sub-area within the region
- $n_bn_bn_b$ - Serial number of the location of the buoy

YYGGi_w - Time of observation & wind speed units indicator

- YY - 2-digit day of month of observation
- GG - nearest whole hour of observation in UTC
- i_w - wind speed units indicator (1 - m/sec)

99$L_aL_aL_a$ - Latitude

- 99 - identifier for latitude group
- $L_aL_aL_a$ - latitude, in tenths of degrees

$Q_cL_oL_oL_oL_o$ - Longitude

- Q_c - quadrant of the globe (1,3,5 or 7)
- $L_oL_oL_oL_o$ - longitude, in tenths of degrees

(Section 1 - Meteorological Data)

i_Ri_xhVV - Cloud height, visibility, and indicator information

- i_R - identifier for inclusion or omission of precipitation data, value always 4 (no precip)
- i_x - indicator for automatic or staffed station, and whether there is a weather group included, value always 6 (auto station and no weather)
- h - height of lowest cloud (not available from buoy data, encoded as /)
- VV - coded visibility (not available from buoy data, always encoded as //)

Nddff - Cloud cover and Surface wind

- N - coded total cloud cover (not available from buoy data, always encoded as /)
- dd - wind direction, to the nearest 10 degrees
- ff - wind speed (m/sec)

00fff - used only when wind speed, in units indicated by i_w, is 99 units or more

- 00 - indicator for wind speed ≥ 99 units (units indicated by i_w)
- fff - actual wind speed (units indicated by i_w)

1s_nTTT - Air Temperature

- 1 - indicator for air temperature group
- s_n - sign of air temperature encoded as 0 if TTT ≥ 0 encoded as 1 if TTT < 0
- TTT - air temperature in tenths of °C

2$s_nT_dT_dT_d$ - Dew Point Temperature

- 2 - indicator for dew point temperature group
- s_n - sign of dew point temperature encoded as 0 if $T_dT_dT_d \geq 0$ encoded as 1 if $T_dT_dT_d < 0$
- $T_dT_dT_d$ - dew point temperature in tenths of °C

4PPPP - Sea level pressure

- 4 - group indicator for sea level pressure
- PPPP - sea level pressure, in tenths of millibars

5appp - 3-hour pressure tendency

- 5 - group indicator for 3-hour pressure change
- a - 3-hour pressure tendency code
- ppp - amount of pressure change, in tenths of millibars

9GGgg - Actual time of observation to the nearest minute(Section 2 - Marine Data)

22200 - Marine data indicator

- 222 - indicator for section 2
- 00 - indicator for stationary platform

0$s_nT_wT_wT_w$ - Sea surface temperature

- 0 - indicator for sea surface temperature group
- s_n - sign of sea surface temperature encoded as 0 if $T_wT_wT_w \geq 0$ encoded as 1 if $T_wT_wT_w < 0$
- $T_wT_wT_w$ - sea surface temperature in tenths of °C

1$P_{wa}P_{wa}H_{wa}H_{wa}$ - Wave period & height

- 1 - indicator for primary wave group
- $P_{wa}P_{wa}$ - wave period, in whole seconds
- $H_{wa}H_{wa}$ - wave height, in half meters

70$H_{wa}H_{wa}H_{wa}$ - High resolution wave height

- 70 - indicator for high resolution wave height group
- $H_{wa}H_{wa}H_{wa}$ - wave height, in tenths of meters

(Section 3 - Regional Data)

333 - Section 3 indicator

912ff - Maximum wind speed

- 912 - indicator for maximum wind speed group
- ff - speed of maximum wind in units indicated by i_w. If wind speed is ≥ 99 units, then ff is encoded as 99 and is followed by the group 00fff, where fff is the maximum wind speed in the units indicated by i_w

(Section 5 - National Data)

555 - Section 5 indicator

555 - indicator for wind speed and maximum gust

11fff - Extrapolated wind at 10 meters

11 - group indicator for extrapolated wind speed at 10 meters above the surface
fff - extrapolated wind speed at 10 meters, in tenths of meters per second above the surface

22fff - Extrapolated wind at 20 meters

22 - group indicator for extrapolated wind speed at 20 meters above the surface
fff - extrapolated wind speed at 20 meters, in tenths of meters per second above the surface

3GGgg - Time of maximum gust

3 - group indicator for time of maximum gust since last observation (in UTC)
GG - hours
gg - minutes

4ddf$_m$f$_m$ - Maximum gust

4 - group indicator for the maximum gust group since last observation
dd - direction of gust, to the nearest ten degrees
f_mf_m - speed of gust, in meters per second

6G$_C$G$_C$g$_C$g$_C$ - Continuous wind data indicator

6 - indicates continuous wind data follow

$G_CG_Cg_Cg_C$ - end time in hours and minutes (UTC) of the latest 10-minute continuous wind group

d$_i$d$_i$d$_i$f$_i$f$_i$ - 10-minute average wind direction and speed (i=1,2,..,5,6: the most recent wind data first (i=1) and each succeeding wind group representing the previous 10-minute average wind data (i=2,...,6))

$d_id_id_i$ - true wind direction in whole degrees

$f_if_if_i$ - wind speed in tenths of meters per second

Drifting Buoy

(Section 0)

M$_i$M$_i$M$_j$M$_j$ - Bulletin header always encoded as ZZXX (included as the first group in each report, even if the report is one of several in a bulletin)

A$_1$b$_w$n$_b$n$_b$n$_b$ - Buoy identifier

A_1 - WMO region in which buoy was launched (Region 1 or 2)
b_w - subarea within the two WMO regions
$n_bn_bn_b$ - drifting buoy number

YYMMJ - Observation date

YY - day of the month
MM - actual month
J - units digit of year

GGggi$_w$ - Observation time

GGgg - whole hour (GG) plus minutes (gg)
i_w - wind speed units indicator (if included)

Q$_C$L$_a$L$_a$L$_a$L$_a$L$_a$ - Latitude

Q_C - quadrant of the globe (1,3,5 or 7)
$L_aL_aL_aL_aL_a$ - latitude, in hundredths or thousandths (depending on capability of positioning system) of a degree (Example: 29°12′ = 702912/)

$L_OL_OL_OL_OL_OL_O$ - Longitude in hundredths or thousandths of a degree (Example: 123°45′ = 12345/)

(Section 1)

0ddff - Wind

0 - wind group indicator
dd - true direction of wind in tens of degrees
ff - wind speed in units indicated by i_w

1s$_n$TTT - Air temperature

1 - air temperature indicator
s_n - indicator for the sign of the temperature
TTT - air temperature in tenths of °C

2PPPP - Sea level pressure

2 - sea level pressure group indicator
PPPP - sea level pressure in tenths of millibars

3appp - 3-hour pressure tendency

3 - 3-hour pressure tendency group identifier
a - 3-hour pressure tendency code
ppp - actual amount of pressure change in tenths of millibars

(Section 2)

222 - Surface Marine Data

0s$_n$T$_w$T$_w$T$_w$ - Sea surface temperature

0 - sea surface temperature group indicator
s_n - indicator for the sign of the temperature
encoded as 0 for $T_wT_wT_w \geq 0$
encoded as 1 for $T_wT_wT_w < 0$
$T_wT_wT_w$ - sea surface temperature in tenths of °C

1P$_{wa}$P$_{wa}$H$_{wa}$H$_{wa}$ - Wave period & height

1 - indicator for primary wave group
$P_{wa}P_{wa}$ - wave period, in whole seconds
$H_{wa}H_{wa}$ - wave height, in half meters

20P$_{wa}$P$_{wa}$P$_{wa}$ - High resolution wave period

20 - indicator for high resolution wave period group
$P_{wa}P_{wa}P_{wa}$ - wave period, in tenths of seconds

21$H_{wa}H_{wa}H_{wa}$ - High resolution wave height

21 - indicator for high resolution wave height group
$H_{wa}H_{wa}H_{wa}$ - wave height, in tenths of meters

(Section 3)

333 - Optional Bathythermal data

(Section 4)

444 - Other optional data

C-MAN (land/fixed site)

(Section 0 - Identification)

$M_iM_iM_jM_j$ - Bulletin header encoded as CMAN, identifies the bulletin as a group of reports from land stations (The bulletin header is not transmitted in the C-MAN, but it is added into a group of reports before they are transmitted in a bulletin)

YYGGi_w - Time of observation, wind speed and units indicator

YY - 2-digit day of month of observation
GG - nearest whole hour of observation
i_w - wind speed units indicator (4 - knots)

iiiii - Station identifier

iiiii - individual C-MAN station identifier; (5 characters: 4 letters and 1 digit)

(Section 1 - Meteorological Data)

i_Ri_XhVV - Indicator information, cloud height and visibility

i_R - identifier for inclusion or omission of precipitation data
i_X - indicator for automatic or staffed station, and whether there is a weather group included, value always 6 (auto station and no weather)
h - height of lowest cloud (not available from C-MAN data, always encoded as /)
VV - average visibility over 2-minute period

Nddff - Cloud cover and Surface wind

N - coded total cloud cover (not available from C-MAN data, always encoded as /)
dd - wind direction, to the nearest 10 degrees
ff - wind speed (knots)

00fff - used only when wind speed is 99 knots or more

00 - indicator for wind speed ≥ 99 knots
fff - average wind speed (whole knots)

1s_nTTT - Air Temperature

1 - indicator for air temperature group
s_n - sign of air temperature
encoded as 0 if TTT ≥ 0
encoded as 1 if TTT < 0
TTT - air temperature in tenths of °C

2$s_n$$T_dT_dT_d$ - Dew Point Temperature

2 - indicator for dew point temperature group
s_n - sign of air temperature
encoded as 0 if $T_dT_dT_d$ ≥ 0
encoded as 1 if $T_dT_dT_d$ < 0
$T_dT_dT_d$ - dew point temperature in tenths of °C

4PPPP - Sea level pressure

4 - indicator for sea level pressure group
PPPP - sea level pressure, in tenths of millibars

5appp - Pressure tendency

5 - group indicator for 3-hour pressure tendency
a - 3-hour pressure tendency code
ppp - amount of pressure change, in tenths of millibars

6RRRt_R - Precipitation

6 - group indicator for precipitation
RRR - liquid equivalent precipitation amount, in millimeters, since last main synoptic time
t_R - indicator for synoptic hours (encoded either as a 1 or a /), not needed by SAODECII

9GGgg - Actual time of observation to the nearest minute

(Section 2 - Marine Data)

222// - Marine data identifier

222 - group indicator for ocean data
//

0$s_n$$T_WT_WT_W$ - Sea surface temperature

0 - group indicator for sea surface temperature
s_n - sign of sea surface temperature
encoded as 0 for $T_WT_WT_W$ ≥ 0
encoded as 1 for $T_WT_WT_W$ < 0
$T_WT_WT_W$ - sea surface temperature, in tenths of °C

1$P_{wa}P_{wa}H_{wa}H_{wa}$ - Wave period & height

1 - indicator for primary wave group
$P_{wa}P_{wa}$ - wave period, in whole seconds
$H_{wa}H_{wa}$ - wave height, in half-meters

70$H_{wa}H_{wa}H_{wa}$ - High resolution wave height

70 - indicator for high resolution wave height groups
$H_{wa}H_{wa}H_{wa}$ - wave height, in tenths of meters

(Section 3 - Regional Data)

333 - Section 3 indicator

912ff - Maximum wind speed

912 - indicator for maximum wind speed group
ff - speed of maximum wind (units indicated by i_w). ff is encoded as 99 when wind speed is greater than 99 knots, and followed by the group 00fff, wher fff is the maximum wind speed in knots.

(Section 5 - National Data)

555 - Section 5 indicator

555 - wind speed and maximum gust indicator

11fff - Extrapolated wind at 10 meters

11 - group indicator for extrapolated wind speed at 10 meters above the surface
fff - extrapolated wind speed in knots at 10 meters above the surface

22fff - Extrapolated wind at 20 meters

22 - group indicator for extrapolated wind speed at 20 meters above the surface
fff - extrapolated wind speed in knots at 20 meters above the surface

3GGgg - Time of maximum gust

3 - group indicator for time of maximum gust since last observation (UTC time)
GG - hours
gg - minutes

4ddf$_m$f$_m$ - Maximum gust

4 - group indicator for the maximum gust group since last observation
dd - direction of gust, in tens of degrees
f_mf_m - speed of gust (whole knots)

6G$_C$G$_C$g$_C$g$_C$ - Continuous wind data indicator

6 - indicates continuous wind data follow
$G_CG_Cg_Cg_C$ - end time in hours and minutes (UTC) of the latest 10-minute continuous wind group

d$_i$d$_i$d$_i$f$_i$f$_i$f$_i$ - 10-minute average wind direction and speed (i=1,2,..,5,6: the most recent wind data first (i=1) and each succeeding wind group representing the previous 10-minute average wind data (i=2,...,6))

$d_id_id_i$ - true wind direction in whole degrees

$f_if_if_i$ - wind speed in whole knots

MWAVE or **PWAVE** - Wave height group indicator

MWAVE - group indicator for maximum wave height followed by a 3-digit wave height (no space), in tenths of meters
PWAVE - group indicator for probable maximum wave height followed by a 3-digit wave height (no space), in tenths of meters

TIDE nnnn - Tide data

TIDE - group indicator for tide data followed by the 4-digit tide level (in hundredths of feet above/below the "mean low low water level")

Section IV-3: Ship Symbolic Format Definitions

Ship & Great Lakes Ship reports

(Section 0 - Identification)

$M_iM_iM_jM_j$ - Bulletin header encoded as BBXX. Identifies the bulletin as a group of reports from ocean stations.

D....D - Radio call sign

YYGGi_w - Time of observation & wind speed units indicator

- YY - 2-digit day of month of observation
- GG - nearest whole hour of observation, in UTC
- i_w - wind speed units indicator

99$L_aL_aL_a$ - Latitude

- 99 - indicator for the position of ship
- $L_aL_aL_a$ - latitude, in tenths of degrees

$Q_cL_oL_oL_oL_o$ - Longitude

- Q_c - quadrant of the globe in which the ship is located (1,3,5,7)
- $L_oL_oL_oL_o$ - longitude, in tenths of degreesDecode Southern Hemisphere reports

(Section 1 - Meteorological Data)

i_Ri_xhVV - Indicator information, cloud height and visibility

- i_R - identifier for inclusion or omission of precipitation data
- i_x - indicator for automatic or staffed station, and whether or not a weather group is included
- h - height of lowest clouds
- VV - coded visibility in miles

Nddff - Cloud cover and Surface wind

- N - cloud amount in tenths
- dd - wind direction, to the nearest 10 degrees
- ff - wind speed (units indicated in i_w)

1s_nTTT - Air temperature

- 1 - air temperature group indicator
- s_n - sign of air temperature encoded as 0 if TTT ≥ 0 encoded as 1 if TTT < 0
- TTT - air temperature, in tenths of °C

2$s_nT_dT_dT_d$ - Dew point temperature

- 2 - dew point group indicator
- s_n - sign of temperature encoded as 0 if $T_dT_dT_d \geq 0$ encoded as 1 if $T_dT_dT_d < 0$
- $T_dT_dT_d$ - dew point temperature, in tenths of °C

4PPPP - Sea level pressure

- 4 - sea level pressure group indicator
- PPPP - sea level pressure, in tenths of millibars

5appp - 3-hour pressure tendency

- 5 - 3-hour pressure tendency group indicator
- a - 3-hour pressure tendency code
- ppp - 3-hour pressure change, in tenths of millibars

7wW$_1$W$_2$ - Present and past weather

- 7 - indicator for weather group
- ww - present weather
- W_1 - most significant past weather since the previous 6-hour synoptic time
- W_2 - 2nd most significant past weather since the previous 6-hr synoptic time

8$N_hC_LC_MC_H$ - Clouds

- 8 - cloud group indicator
- N_h - amount of C_L (or C_M) cloud
- C_L - wx code for principal type of low cloud
- C_M - wx code for principal type of middle cloud
- C_H - wx code for principal type of high cloud

(Section 2 - Marine Data)

222D_SV_S - Ship's course & speed

- 222 - group & section indicator
- D_S - course during last 3 hours
- V_S - average speed during last 3 hours

0$s_nT_WT_WT_W$ - Sea surface temperature

- 0 - group indicator for sea surface temperature
- s_n - sign of sea surface temperature encoded as 0 for $T_WT_WT_W \geq 0$ encoded as 1 for $T_WT_WT_W < 0$
- $T_WT_WT_W$ - temperature in tenths of °C

2$P_WP_WH_WH_W$ - Sea waves

- 2 - sea waves group indicator
- P_WP_W - wave period, in seconds
- H_WH_W - wave height, in half meters

3$d_{W1}d_{W1}d_{W2}d_{W2}$ - Swell direction

- 3 - swell direction indicator
- $d_{W1}d_{W1}$ - direction from which predominant swell is moving, in tens of degrees
- $d_{W2}d_{W2}$ - direction from which secondary swell is moving, in tens of degrees

4$P_{W1}P_{W1}H_{W1}H_{W1}$ - Predominant swell

- 4 - predominant swell group indicator
- $P_{W1}P_{W1}$ - period of swell, in seconds
- $H_{W1}H_{W1}$ - height, in half meters

5$P_{W2}P_{W2}H_{W2}H_{W2}$ - Secondary swell

- 5 - secondary swell indicator
- $P_{W2}P_{W2}$ - period, in seconds
- $H_{W2}H_{W2}$ - height, in half meters

$6I_SE_SE_SR_S$ - Ice accretion

6	-	ice accretion group indicator
I_S	-	cause of ice accumulation
E_SE_S	-	thickness of ice accumulation, in centimeters
R_S	-	rate of ice accumulation

ICE - drifting ice group indicator

$c_iS_ib_iD_iz_i$ - Drifting ice

c_i	-	concentration of ice
S_i	-	stage of development
b_i	-	ice of land origin
D_i	-	bearing of ice edge
z_i	-	situation and trend

Section IV-4: Coast Guard Symbolic Format Definitions

Coast Guard reports

iii - Site Identifier

wwVV - State of Sky, Weather, and Visibility

ww - Appropriate state of sky and/or weather abbreviation(s)
VV - Visibility in miles

dddff - Wind direction and speed

ddd - Direction, based on the sixteen-point compass (S, SSW, SW, etc.)
ff - Speed, in knots

$P_{wa}P_{wa}H_{wa}H_{wa}$ - Wave period & height

$P_{wa}P_{wa}$ - wave period, in whole seconds
$H_{wa}H_{wa}$ - wave height, in feet

T_wT_w - Water temperature in °F

TT - Air temperature in °F

pppp - Sea level pressure in hundredths of an inch

RMKS - Free text remarks

Station name - free text station name

APPENDIX V

The Universal Graphics Generator (UGG) Plot File

The secondary program (PLTGEN) of the SAO Decoder package reads the SAODATA file created by SAODECII and writes a Universal Graphics Generator (UGG) plot file. This file can then be used by PMOD or REGPLOT to produce the necessary input to the graphic plotting program GENUTF. As noted in the body of this CP, the plot file may be stored by PLTGEN either in the AFOS database as the product "NMCPLTSAO", or as an RDOS file "GP".

While the formatting of the UGG plot file is essentially transparent to the user, it is desirable to understand the format and meaning of the various data in the plot file. It will occasionally be necessary for the user to carefully examine the PLTGEN output for possible decoding errors and erroneous observations.

The UGG plot file, whether produced by PLTGEN or another means, consists of a header line and usually several logical lines. The actual number of logical lines is strictly determined by the number of observations which have been successfully decoded. The generic format of the plot file is given below.

The header line of the UGG plot file takes on the format of:

CCCNNNXXX, PI, GS, IMAX, JMAX, IOFF, JOFF, IPOLE, JPOLE, TTDDMMYY, CUT TIME

(Note that the fields above in reality follow one directly after the other without the commas.)

CCCNNNXXX [cols. 1-9]	- AFOS Product identifier of the plot file, usually NMCPLTSAO for SAODECII output.
PI [cols. 10-12]	- Projection indicator (e.g., polar-stereographic, Mercator, etc...)
GS [cols. 13-17]	- Geography scale: the numeric ratio of the projection scale in ten thousands (e.g., 1:20 million scale means a GS of 02000.
IMAX [cols. 18-21]	- Width of the intended plot product in pixels.
JMAX [cols. 22-25]	- Height of the intended plot product in pixels.
IOFF [cols. 26-29]	- The i coordinate point, in pixels, of the lower left corner of the intended plot product relative to the map background.
JOFF [cols. 30-33]	- The j coordinate point, in pixels, of the lower left corner of the intended plot product relative to the map background.
IPOLE [cols. 34-38]	- The i coordinate point, in pixels, formed by an imaginary line from the lower left coordinate point of the plot product to the north pole. (This is used to help determine the correct plot angle of the wind barbs).
JPOLE [cols. 39-43]	- The j coordinate point, in pixels, formed by an imaginary line from the lower left coordinate point of the plot product to the north pole.
TTDDMMYY [cols. 44-51]	- UTC time, day, month, and year of the plot product.
CUT TIME [cols. 52-55]	- The time at which data collection for this plot product was cut off based on a 24-hour clock. For PLTGEN, this is usually 0000.

The logical lines, with the exception of the first two lines following the header line, which contain the date and title of the plot product, conform to the following format (the commas are required):

i_{pix},j_{pix},PSOWDT,TTTT,$I_dI_dI_dI_d$,N_h,DDDFF,PPP,TT,T_dT_d,WW,VV,PP,A,
$C_lC_mC_l$,RRR,GG,D_sV_s,$W_pW_pW_hW_h$,$S_dS_dS_pS_pS_hS_h$,T_wT_w (or SNOW),SPCL

Definitions of fields:

i_{pix}	- i pixel for plotting this station.
j_{pix}	- j pixel for plotting this station.
PSWODT	- PMOD plotting parameter characteristic (defined below).
TTTT	- UTC of the observation.
$I_dI_dI_dI_d$	- Station ID (truncated to 4 letters max).
N_h	- Cloud cover in octants.
DDDFF	- 3 digit wind direction and 2-digit wind speed in knots.
PPP	- Sea-level pressure in tenths of mb without the leading digits of "8", "9", or "10".
TT	- Temperature in degrees Fahrenheit.
T_dT_d	- Dewpoint temperature in degrees Fahrenheit.
WW	- Present weather code (see pages 4-17 to 4-29 in FMH #2, 1988).
VV	- Visibility code (see page 4-5 in FMH #2, 1988).
pp	- 3 hour pressure change value in tenths of mb.
a	- Pressure tendency characteristic (see page 4-12 in FMH #2, 1988).
C_l	- Low cloud type (see page 4-38 in FMH #2, 1988).
C_m	- Middle cloud type (see page 4-41 in FMH #2, 1988).
C_h	- High cloud type (see page 4-44 in FMH #2, 1988).
RRR	- 3/6 hour rainfall in hundredths of inches.
GG	- Wind gust in knots.
D_sV_s	- Coded ship direction and speed (see pages 5-1 through 5-3 in FMH #2, 1988).
$W_pW_pW_hW_h$	- Wave period in seconds and wave height in half meters.
$S_dS_dS_pS_pS_hS_h$	- Swell direction, period in seconds, and height in half meters.
T_wT_w	- Sea surface temperature in degrees Fahrenheit (plotted only at marine stations).
SNOW	- Snow depth in inches preceded by the letters "SN" (plotted only at land stations).
SPCL	- Special field not used by PLTGEN.

PWSODT:

P - priority threshold for displaying stations:
0 = station displayed at all zoom levels;
1 = station displayed at 4:1 or higher zoom level;
2 = station displayed at 9:1 or higher zoom level;
3 = station displayed at 16:1 or higher zoom level.

S - size of the fonts (if plotted directly on Versatec):
0 = default (11 pixels);
1, 2, or 3 = will be multiplied by 7 pixels.

(if product is displayed on the GDM):
0, 1, or 2 = will product normal fonts;
3 = double size fonts.

O - orientation (rotation for Versatec; the parameter has no effect if you are using the GDM):
0 = 0°;
1 = 90°;
2 = 180°;
3 = 270°.

W - special fonts:
This parameter determines the horizontal and vertical field width that will be allocated for the station plot model. The width required will be determined by the present weather field WW listed above.
0 = no special fonts to be plotted;
1 = single special symbol (11 x 11 pixels - default size);
2 = double horizontal symbol (22 x 11 pixels);
3 = double vertical symbol (11 x 22 pixels);
4 = quadruple size symbol (22 x 22 pixels);
9 = normal text string output of 4 characters or less.

D - wind group plotting convention:
0 = Northern Hemisphere; wind barbs plotted to the right of the staff; no wind direction tens digit plotted;
1 = Northern Hemisphere; wind barbs plotted right of the staff; wind direction tens digit plotted near end of staff;
2 = Southern Hemisphere; wind barbs plotted left of staff; no wind direction tens digit plotted;
3 = Southern Hemisphere; wind barbs plotted left of staff; wind direction tens digit plotted near end of staff;

T - report type indicator:
A = upper air land based report;
B = upper air ship based report;
C = RECON report;
D = AIREP report;
E = satellite soundings;
F = satellite winds;
G = bogus upper air data;
Z = product title entry;
1 = surface synoptic report;
2 = surface airways report;
3 = ship surface report;
4 = MARS report;
5 = buoy report;
6 = surface bogus data;
7 = automatic surface station (ASOS, AWOS, AMOS, etc...)

The following is a sample plot file as it would appear as an RDOS file or as the AFOS product NMCPLTSAO. Either is displayable at the ADM.

```
NMCPLTSAO0010200002048153628501425009750168818110693000[1]
119,290,10000Z, SAO SURFACE OBSERVATIONS;[2]
119,270,10000Z,    18Z   11  06  93 ;[2]
1045,477,000017,1156,AMA,0,21005,149,29,27,,66,04,3,,,,,,,,,SN07[3];
1400,984,000112,1050,ALB,6,18004,185,70,69,10,12,,,,,,;[4]
1404,783,000012,1500,YYZ,3,35006,208,81,68,,80,14,1,,,,;[5]
1146,40,000112,1545,MEX,6,00000,,66,55,05,32,,,,,,;[6]
1624,823,000013,1200,NFMK,3,22010,247,72,70,,60,-03,6,400,,,,,62,0201,250302,
73;[7]
1577,633,000015,0900,SNL7,M,25016,172,76,68,,,-03,6,,,G17,,,,0767,,61;[8]
1292,355,000015,1100,D030,M,23002,181,83,,,,,,,,,,,,,,85;[9]
1297,786,000013,1500,4141,0,19009,200,70,,,69,15,2,,,,,,32,//00,,86;[10]
END
```

[1] - Header for UGG plot file.
[2] - Title lines.
[3] - SAO report for U.S. ASOS station.
[4] - SAO report for manual U.S. station.
[5] - SAO report for manual Canadian station.
[6] - SAO report for manual Mexican station.
[7] - Ship report.
[8] - C-MAN buoy report.
[9] - Drifting buoy report.
[10] - Moored buoy report.

APPENDIX VI

Error Conditions

The error conditions listed below are printed on the Dasher. Most of the errors are fatal. Those which are not are denoted as such. Fatal errors will cause immediate termination of the program SAODECII. If these errors occur, you should first check for missing files or links as indicated. If this is not the problem, then the error is most likely the result of a system or disk related problem. If no apparent reason for the error can be found, then you should call the maintenance programmer listed in Section 6, Part A of this CP.

Errors caused by erroneous observations are not listed in this Appendix. Instead, these errors can be found on the line printer or PPM when the global "X" and "G" switches are used on the SAODECII command line. The printout lists the word location of the error or errors and the corresponding octal value of the observed apparently erroneous data. Erroneous observations almost never cause termination of SAODECII, but can result in incorrect data being written to SAODATA and/or SAODATASUP. Observations should be manually examined when plots or printouts of data display highly suspect or totally incorrect information.

Errors below are numbered for reference and would appear as such on the Dasher upon their occurrence. At the end of the error message, the module in which the error occurred is given in braces. Sequences of x's denote integer values which would be printed at that point in the error message, while a sequence of a's denotes characters (LOCALDATA, LOCALlDATA, etc...) which would be printed at that point in the error message.. Please note the information listed in this paragraph when contacting the maintenance programmer.

*[Ø1]*Error getting channel for overlay SAODECII.OL-(SAODECII).

*[Ø2]*Error opening overlay SAODECII.OL-(SAODECII).

*[Ø3]*Error reading system time-(SAODECII).

*[Ø4]*Error reading system date-(SAODECII).

*[Ø5]*Error loading overlay OSAOINT-(SAODECII).

*[Ø6]*Error creating SAODATA file-(SAODECII).

*[Ø7]*Error getting channel for SAODATA file-(SAODECII).

*[Ø8]*Error opening SAODATA file-(SAODECII).

*[Ø9]*Error in WRS to SAODATA-(SAODECII).

*[1Ø]*Error creating SAODATASUP file-(SAODECII).

*[11]*Error getting channel for SAODATASUP file-(SAODECII).

*[12]*Error opening SAODATASUP file-(SAODECII).

*[13]*Error in WRS to SAODATASUP-(SAODECII).

*[14]*Error getting channel to append to SAODATA-(SAODECII).

*[15]*Error opening SAODATA for append-(SAODECII).

*[16]*Error getting byte pointer position for append to SAODATA-
(SAODECII).
*[17]*Error setting byte pointer position for append to SAODATA-
(SAODECII).

*[18]*Error getting channel for append to SAODATASUP-(SAODECII).

*[19]*Error opening SAODATASUP for append-(SAODECII).

*[2Ø]*Error getting byte pointer position for append to SAODATASUP-
(SAODECII).

*[21]*Error setting byte pointer position for append to SAODATASUP-
(SAODECII).

*[22]*Error loading overlay ORDSKEL-(SAODECII).

*[23A]*Error loading overlay OSAFV-(SAODECII).

*[23B]*Error loading overlay OONEOB-(DTRNGE).

*[24]*Error loading overlay OMXFV-(SAODECII).

*[25]*Error loading overlay OSHFV-(SAODECII).

*[26]*Error loading overlay OBYFV-(SAODECII).

*[27]*Error loading overlay OCGFV-(SAODECII).

*[28]*Error loading overlay OINFV-(SAODECII).

*[29]*Error writing "end-of-file" (EOF) to SAODATA file-(SAODECII).

*[3Ø]*Error writing EOF to SAODATASUP file-(SAODECII).

*[31A]*Error opening channel to read command line-(SAOINT).

*[32]*Error creating SAOXXX file-(SAOINT).

*[33]*Error getting channel for SAOXXX file-(SAOINT).

*[34]*Error opening channel for SAOXXX file-(SAOINT).

*[35]*Error in WRS to SAOXXX file-(SAOINT).

*[36]*Error opening CCCLIST-(SAOLST).

*[37]*Error reading CCCLIST-(SAOLST).

*[38]*Error getting channel for DATAKEYØ-(AFSP).

*[39A]*Error opening DATAKEYØ-(AFSP).

*[39B]*RDB error = xxx File = aaaaaaaaaa RDOS block no. xxxxxx -(AFSP).
(non-fatal)

*[39C]*RDB error = xxx RDOS block no. xxxxxx -(AFSV).
(non-fatal)

*[39D]*RDB error = xxx RDOS block no. xxxxxx -(AFSB).
(non-fatal)

*[4Ø]*Error alphabetizing/rewriting CCCLIST-(CNXALP).

*[41]*Error getting channel for DATAKEY0-(RDSKEL).

*[42]*Error opening SKEL file-(RDSKEL) IER = xxx.

*[43]*Error reading SKEL file-(RDSKEL) IER = xxx.

*[44]*Error closing DATAKEYØ file-(RDSKEL).

*[45]*Error getting channel for DATAKEYØ-(RDK1).

*[46]*Error opening DATAKEYØ file-(RDK1) IER = xxx.

*[47]*Error reading DATAKEYØ-(RDK1) IER = xxx RECORD NO: xxxxx.

*[48]*Error reading DATAKEYØ-(RDK1) IER = xxx RECORD NO: xxxxx.

*[49]*Error getting channel for DATAKEYØ-(RDK2).

*[5Ø]*Error opening DATAKEYØ file-(RDK2) IER = xxx.

*[51]*Error reading DATAKEYØ-(RDK2) IER = xxx. RECORD NO: xxxxx.

*[52]*Error reading DATAKEYØ-(RDK2) IER = xxx. RECORD NO: xxxxx.

*[53]*SAOCLTVID.DT file non-existent-(TYPREP)

*[54]*Invalid characters in SAOCLTVID.DT file-(TYPREP)

*[55A]*Error loading overlay OSKY-(SAOBS).

*[55B]*Error loading overlay OSKY-(SAOBS).

*[55C]*Error loading overlay OTEMPDP-(SAOBS).

*[55D]*Error loading overlay OTEMPDP-(SAOBS).

*[55E]*Error loading overlay OGAPPRR-(SAOBS).

*[56]*Error loading overlay OGRS1-(SAOBS).

*[57]*Error loading overlay OONEOB-(MXFV).

*[58]*Error loading overlay OONEOB-(MXOBS).

*[59]*Error loading overlay OSKY-(MXOBS).

*[6Ø]*Error loading overlay OGRS1-(MXOBS).

*[61]*Error loading overlay OONEOB-(CGFV).

*[62]*Error loading overlay OONEOB-(CGOBS).

*[63]*Error loading overlay OSKY-(CGOBS).

*[64]*Error loading overlay OGRS1-(CGOBS).

*[65]*Error loading overlay OONEOB-(BYFV).

*[66]*Error loading overlay OONEOB-(BYOBS).

*[67]*Error loading overlay OGRS1-(BYOBS).

*[68]*Error loading overlay OONEOB-(SHFV).

*[69]*Error loading overlay OONEOB-(SHOBS).

*[7Ø]*Error loading overlay OGRS1-(SHOBS).

*[71]*Error loading overlay OONEOB-(INFV).

*[72A]*Error loading overlay OONEOB-(INOBS).

*[72B]*Error loading overlay OSKY-(INOBS).

*[73A]*Error loading overlay OTEMPDP-(INOBS).

*[73B]*Error loading overlay OTEMPDP-(INOBS).

*[73C]*Error loading overlay OGAPPRR-(INOBS).

*[74]*Error loading overlay OGRS1-(INOBS).

*[75]*Fatal error in ONEOB from AFSB-(ONEOB).

*[76]*Aborting ONEOB: Excessive calls to AFSB-(ONEOB).
(non-fatal)

*[77]*Aborting ONEOB: Excessive calls to AFSB-(BONOB).
(non-fatal)

(Continued from inside front cover)

Computer Program NWS TDL

CP 92-1 Separating Individual Synoptics from within Synoptic Collectives. Robert A. Beasley, August 1992. (PB92232313)

CP 93-1 AFOS Profler Software System. Battel, Leaphart, Moeller, and Petrie, August 1993